

Electronic Forms Platform

António de Sousa Ferreira
antonio.ferreira@tecnico.ulisboa.pt

Instituto Superior Técnico, Lisboa, Portugal

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Abstract

The big challenge for today's global society is about how to harness the power of information and communication technologies, aiming to improve and increase the capacity of developing countries government's, modernizing its policies and helping its citizens by improving the human conditions of its people. The Government of Mozambique is beginning to take the necessary steps for the implementation of an e-Governance model for this purpose. Starting from a point when the bureaucracy ruled in all public administration processes, associated with massive physical documentation support, often disregarding citizens' interests, and now undergoing a new reality which seeks agility, the Government is trying to bring citizens and public administration closer, through a revolution in the quality and efficiency of processes. This document presents a solution that boosts the Public Administration accordingly. The Electronic Forms Platform aims to empower citizens, giving them tools to interact with public services in a quick, safe and convenient manner. Another goal, also of utmost importance, is to facilitate access to process information, favoring the digital documentation, in order to provide a better service and fairer society.

Keywords: Electronic Forms Platform, e-Government, Mozambique, Orbeon Forms, Design Thinking

1. Introduction

INTIC is a Mozambique public institution that is responsible for the reform and modernization of public services through the ICT (Information and Communications Technologies). Guided by the effort of the Mozambique Government to modernize the public administration and considering the growing need of a better approach to the Mozambican citizens, INTIC launched an international competition in 2011 for the purchase of consultancy services for the conceptualization of the "Fundamental Solution for Electronic Govern-

ment in Mozambique". The development for this solution was awarded to Novabase and provided the following modules:

- Development of the model for shared services for e-Government;
- Specification of the e-Government Interoperability Framework of the Government of Mozambique;
- Conceptualization of the e-Government Services Operation Center;

- Develop a Training Plan for Institutional Communication to disseminate and present the Model for e-Government in Mozambique.

In 2013, an *addendum* to this contract was created which included, among others, the module which originated the project here described. Through this module, the Government of Mozambique planned the delivery of a registration and information storage platform, oriented to its citizens. This platform should allow in an agile and secure manner the availability of several electronic forms, integrated with the various ministries, without specialized intervention of information technology personnel. The platform also serves as streamlining agent of administrative processes, decentralizing the information points, allowing greater efficiency and speed in collecting information and in the computerization of these processes. The implementation of this platform would significantly improve the control for the available information, rationalizing operating costs. Another advantage would be to create a single document repository to reuse the attached documentation. All these aspects would bring the streamlining of the current processes.

1.1. Project

This document describes the project involving the conceptualization, design and development for a solution to the problem described in the previous section. This project was executed in Novabase¹, a Portuguese company founded in 1988 that operates in the ICT sector.

Planned to last one year, the project began in December 2013 and lasted until June 2014, when it was suspended by administrative decision. At the time of suspension, all analysis, design and development tasks had been completed on schedule.

Since its suspension until this document's publication date, Novabase and the Government of Mozambique in several occasions tried to resume the project execution, but this was not possible. However, both parties assumed that this is an utmost importance project, and will continue to work to find a solution to unblock this situation.

¹<http://www.novabase.pt>

1.2. Document Structure

This document is composed as follows. Section 2 presents the methods used for the analysis, design and development phases. Then it approaches the architectural pattern chosen for the solution and describes the support tool used in creating and publishing the electronic forms. Section 3 describes the problem which originated this project. Section 4 presents the solution to the problem described in the previous section and the method used to achieve it. Section 5 describes the development of the various parts that constitute the solution. Section 6 provides a summary of all the work involved and presents some thoughts on the current state of the platform and on its future.

2. State of the Art

This section presents the methods used for the analysis, design and development of this project. Afterwards, MVC architectural pattern and the technology used for the creation and publication of electronic forms is presented.

2.1. Design Thinking

Although the term "design" is often associated with quality and/or aesthetic appearance of a product, design as a discipline has the ultimate goal to promote well-being in people's lives. However, it is the way designers perceive things and act on them that leads to Design Thinking (Vianna et al. (2012)).

According to Martin (2009) two ideas prevail on how to create business value. One side emphasizes the importance of "analytical thinking", logic and certainty. The other side emphasizes "intuitive thinking" and pure creativity. At first sight the two seem irreconcilable. The solution is a third option, the Design Thinking, which provides a "dynamic interaction" between these two views, helping the company to adjust and refine the existing knowledge, but also facilitating innovation and discovery.

Lockwood (2010) defines Design Thinking as an innovation process, centered on the human being, emphasizing observation, collaboration, rapid learning, visualization and prototyping. The goal is not only to solve the problem in sight, but the

real problems behind the obvious. The best way to do this is to involve all interested people in one integrative process. This process can be applied to products, services or even business problems. It is also a tool to imagine future states and to introduce products, services and experiences in the market.

For Brown (2008) Design Thinking is a discipline that uses the sensitivity and designers methods to meet the needs of people, offering something that is technologically feasible. By combining the desirable aspect from the human point of view with the technologically and economically feasible, the designers have managed to create the products we use in our day-to-day. The Design Thinking puts these tools in the hands of people who may never have thought of themselves as designers and allows them to apply them in a wide variety of problems.

The design thinking process consists of three stages designated as "spaces", instead of a predefined set of steps (Brown (2009)). These spaces are inspiration, ideation and implementation:

- **Inspiration:** is the stage when one tries to understand the context of the problem and the needs behind it. In the end, all collected information is analyzed and synthesized so that it can be shared and disseminated by the team involved in the project.
- **Ideation:** is the stage that creates and designs the solution based on the information and knowledge collected in the previous phase, applying the brainstorming technique. It is very important at this stage that all stakeholders actively participate and that the ideas and chosen solution should be assessed on its merits and not considering who presented it.
- **Implementation:** is the transposition of the ideas resulting from the previous stage to reality. It is essentially a trial and test phase in which the team builds and improves the solution through prototyping. Here it is possible to test various alternatives for the design and behavior of a fast interface before writing a single line of code. Another technique also used, which complements the use of prototypes, is role-play. Enact real situations with

prototypes helps validating and generate better contributions to the team who is in charge of building the solution. As a result of executing a process step, it is common to review the earlier stages as more information is gathered. The process ends when the solution is accepted by all parties.

2.2. Scrum

Scrum is an Agile framework created in the 90s by Ken Schwaber and Jeff Sutherland to develop and maintain complex products (Schwaber & Sutherland (2011)). Its definition consists of a set of roles, events and artefacts, where each component has a specific and essential purpose for its successful use. To unite all components, Scrum contains rules that govern the relationships and interactions between these components. In addition to the components, the Scrum assumes that all team members share the same values, which are the foundation of Scrum (Scrum Alliance (2014)): concentration, courage, openness, commitment and respect.

2.2.1 Roles

- **Product Owner:** is responsible for providing the maximum possible value on the desired date by managing the work that is distributed to the team, and selecting and refining the items in the Product Backlog.
- **Scrum Master:** helps the team in the implementation of Scrum framework acting as a facilitator of the Daily Scrum meetings and encouraging self-organization of the development team.
- **Development Team:** professionals who work to deliver the Product Increment.

2.2.2 Artefacts

- **Product Backlog:** is an ordered list that contains all the desired features. It is the single source of product design requirements.
- **Sprint Backlog:** is the set of Product Backlog tasks that the team is committed to develop along with the Product Owner during the Sprint.

- **Product Increment:** is the result of each Sprint and is the most important artifact of Scrum. Corresponds to an integrated version of the product with enough quality to be delivered to users.

2.2.3 Events

- **Sprint Planning Meeting:** is a limited duration meeting held by all the Scrum team, to plan the work to be done in a sprint. This assembly consists of two parts. The first defines the work to be done in the Sprint. In the second part, the development team decides how to do the work.
- **Daily Scrum:** a short meeting, (maximum 15 minutes), with the members of the Scrum team. However, other interested elements in the project can be present. The development team uses these meetings to ensure everyone is aligned with the Sprint goal. The meeting should take place every day at the same place and time. Each element of the development team must answer three questions:
 1. What have I done since the last Daily Scrum;
 2. What I intend to do until the next Daily Scrum;
 3. What is preventing my advance;
- **Sprint Review:** is an informal meeting, with limited duration, held on the last day of the Sprint to inspect the Product Increment and, if necessary, adapt the Product Backlog
- **Sprint Retrospective:** is a formal meeting, with limited duration, solely destined for the Scrum team, in order to see how the last Sprint went in terms of people, relationships, processes and tools; identifying and ordering the main strengths and opportunities for improvement; and finally, to create a plan to implement these improvements.

2.3. MVC

The MVC (Model-View-Controller) is a software architectural pattern, created in 1979 by Trygve Reenskaug, which is based on the separation of

an application's business logic and its presentation logic, through its decomposition into three components: models, views and controllers. The goal is to separate the application state (model) from the way it is presented to the user (views) and from the way the users control the application (controllers) (Masoud et al. (2006)). Due to the isolation of several components, they become easier to develop, test and maintain, and this is one of the most widely used standards for web applications (Yalezo & Thinyane (2013)). It is possible, for example, dramatically change the interface of an application or data model support without altering the other components (Leff & Rayfield (2001)).

The **model** is responsible for maintaining the state of application. This responds to information requests on their status, usually from views for the user's information presentation, and to changes to that state, usually from controllers.

The **views** are responsible for presenting the information contained in the model to the user.

The **controller** is responsible not only for accepting and process user interactions, but also for the changing state logic in the application in response to these actions. After the changes occur in the model, the controller initiates the creation of a new view.

2.4. Orbeon Forms

The Orbeon Forms² is an open-source platform to create, publish and manage electronic forms. It provides several tools to create and publish online forms: Form Builder, Form Runner and forms repository.

The Form Builder is a web application that allows building and publishing forms in minutes with a "What You See Is What You Get" (WYSIWYG) behavior type, that is, allows the user to see which will be the form's end result while you are building it. Its main features are:

- **100% web-based:** Form Builder does not require installing any software on the user's computer: and doesn't need any browser plugins or extensions.
- **Rich data validation and controls:** Form Builder supports common datatypes for vali-

²<http://www.orbeon.com>

ation and user interface controls, as well as attachments and pictures.

- **Accessible forms:** Forms produce use either Ajax or a more accessible mode without scripts.
- **Built-in runtime environment:** With a single click, your form is deployed into the Form Runner runtime environment and users can start filling-out data.
- **Version control:** Allows a form to have multiple versions simultaneously.

The Form Runner is the application in charge for the forms repository. It is possible to manage all published forms and their instances. You can check all completed forms and fill out a new form or edit it.

3. Problem

This section describes the challenge that was put to me and Novabase. Here are presented the objectives that the Government of Mozambique intends to achieve with the realization of this project and the solution requirements.

3.1. Goals

The main project objective was to create an electronic platform that brings citizens and Public Administration closer. This platform will unify and standardize the availability and the filling of forms, ensuring uniformity in the provision of public service. This new channel will eliminate the spread of forms throughout various portals of Public Administration, promoting greater usability and a better experience for citizens.

In addition to providing and completing the forms, the platform will allow its distribution and management by the responsible public bodies. This platform will also enable the automation of all documentation submitted in balconies through the forms, thus removing all existing paper flow, streamlining processes, minimizing costs and the associated times.

The aim is to achieve the following improvements in executing Public Administration processes:

- **Quality of the Information that is collected near the citizen:** During the form platform construction it is possible to set form filling rules, for example, mandatory fields or expiration dates/numbers, ensuring that the information is valid and readable compared to manually completed forms.
- **Quick and reliable access to the information submitted by citizens:** At any-time, anywhere the information is accessible, as well as the documentation that was attached during the form submission.
- **Single information and documentation repository:** All information, forms and documentation will be gathered and stored in a single repository, accessible on the internet.
- **Decreases the number of ‘ghost process’ occurrences:** Once form submission will be subject to fulfillment rules and required documents, the provincial services will review only the valid processes. This intends to eliminate all cases where there is an expression of interest but where the necessary information to continue the process was not given.
- **Reduction of operational costs for the Public Administration:** With the availability of communication interfaces with other public administration information systems, and considering the ease in validating information and documentation, and digital storage of data, it is expected a considerable decrease in operational costs.
- **Paper dematerialized:** Since the platform will provide a digital documentation repository, the citizen no longer needs to deliver multiple document copies, and its storage and transport between the various entities involved in the process will not be necessary.
- **Citizens closer to Public Administration:** Taking into account that the platform will be available on the internet, citizens can consult it at any place and time.
- **Greater flexibility in form updates and required documentation rules:** the availability of forms in an electronic platform will

make easier and faster to manage any changes in the forms or changes to the mandatory documentation list.

- **Monitoring and reporting:** The platform will provide a reporting mechanism making possible to view and monitor the amount of submitted forms and response times in the various Public Administration services

3.2. Functional Requirements

Functional requirements specify the features that a system must support to enable users to carry out their tasks, meeting the business requirements (Wiegiers (2003)). The requirements listed here are not exhaustively detailed, but describe the main features that the platform should meet:

1. Citizen should register by choosing a password.
2. Citizen should be able to recover the password.
3. Citizen should be able to change password.
4. Citizen should be able to consult, complete and submit forms.
5. Public Administration personnel should be able to perform all operations on behalf of the citizen.
6. Public Administration personnel should be able to associate documents during the filling of forms by the citizen.
7. Public Administration personnel are able to consult and analyze submitted forms.
8. It should be made available context sensitive help on the use of the platform and on completing the forms.
9. A web services interface should be provided to third parties information systems, so that submitted forms could be consulted and also to perform updates in the process states.

4. Solution

This section presents the proposed solution to the objectives and requirements identified in the previous chapter. The method for building the solution is described, followed by its architecture.

4.1. Method

Given that at the initial phase of the project we only had a general description of the requirements, design and architecture intended for the platform and access to the client was very limited, it was decided to opt for the method Design Thinking to get to the design of the solution. The Design Thinking seemed the most appropriate choice to create a solution which would be innovative, technologically feasible and focused on the end users. With this method it was possible, jointly with the client, properly characterize the problem and create a solution that responded to the real needs of users, not just to those requirements already identified.

As described in Section 2, the Design Thinking method foresees three phases to produce a solution: Inspiration, Ideation and Implementation. We present hereinafter how these steps have been performed:

- **Inspiration:** at this stage we tried to understand the problem and to have the first contact with the client. After the project's kick-off, still in Portugal, we begun to search on the internet information about the client, the country, its citizens and which services were already made available by Public Administration on the internet. Later, in Mozambique, we held meetings with the client, did some interviews with citizens and visited service centers where the platform could become available. The majority of citizens showed great empathy with the idea of filling out online forms, but unfortunately in the Mozambican reality, the access to internet through a domestic computer isn't common. Aware of this, the client predicted that filling out the forms should also be available in citizen service centers, especially created for this purpose. During visits to the service centers the disarray and congestion was visible due to the huge amount of paper and the lack

of operational means. Public Administration employees considered the platform an asset, as dramatically reduces the amount of paper circulating and citizens who have access to the internet no longer to travel to the service counters to just hand out forms. A key factor for the success of this phase was the client's involvement in the problem characterization process. He was invited to join us and together we draw the perfect solution to his problem.

- **Ideation:** in this phase several brainstorming sessions were held and all the ideas were written on whiteboards. In these sessions all project stakeholders were involved to devise a solution that responded to the processes and to the identified requirements. The goal was to build a solution for a people-focused web platform, keeping in mind that in a country like Mozambique the access to computers and internet is very limited, and all tasks should be able to be carried out by technicians of Public Administration spread by various call posts, throughout the territory. Thus, an electronic platform was imagined, one that was available on the internet and allows: citizens, to register and thereafter consult, complete, associate documentation and submit electronic forms; the Public Administration services, to consult and validate information entered, but also to complete, associate documentation and submit forms by citizens; and INTIC, to create, publish and maintain the forms available on the platform. These respective forms and associated documents, after being validated by specialists, are available for consumption by the public body or institution to which they were intended.
- **Implementation:** at this stage screens prototypes with the main features identified in the previous phases were created. Those prototypes allowed us to evaluate the way users interacted with the interface and if the application's behavior met the requirements. These prototypes were continuously made available to key users who used them and gave their contributions. In this way it was possible to try several design alterna-

tives and forms of interaction with the users, in an easy, fast and inexpensive way. Thus, the prototypes evolved iteratively until all requirements were satisfied. This technique allowed to materialize the vision for the platform and validate that the assumptions made so far were correct and assimilate any request for change before even beginning to develop.

4.2. Architecture

This section presents the platform's architecture components, internal and external, and describes its usage profiles.

4.2.1 Internal Components

In order to achieve the desired goal, came to the conclusion that it would take four internal components: three web portals and a services layer. Let us now turn into decomposing the various components within the architecture:

- **Public Portal:** Portal available to citizens on the internet to fill, submit and consult electronic forms. It also contains a digital documents repository and a help area through a collection of FAQs.
- **Private Portal:** Portal available to government employees on the Internet for filling, submission and consultation of electronic forms on behalf of citizens, but also for review, analysis and approval of previously submitted forms.
- **Management Portal:** Portal available in INTIC's internal network for platform management. It allows to manage (create, modify, publish and delete) the forms provided and FAQs as well as other operations related to the platform.
- **Services:** Web services available on the internet allowing various Public Administration departments' access to approved forms and attached documentation, but also update the status of the processes associated with those forms.

The architectural pattern chosen for the solution was the MVC, described in Section 2, as it allows

the development, maintenance and testing of its the various components independently. With this architecture it will be possible, for example, to change the database manager or to create a mobile version of the portals without having to make structural changes to the system.

4.2.2 External Components

The external components complement the existing functionalities in the main components in order to meet all the system requirements. In the system in question there is only one external component, the Orbeon Forms. This component is used by the main system, which consists of four internal components, to create and publish electronic forms.

4.2.3 User Profiles

The platform will have five users profiles identified during the analysis of the problem:

- **Citizen:** Citizens wishing to use the Electronic Forms Platform. Citizens can register on the platform, complete, submit, view and associate documents to forms.
- **Technician:** Public Administration employees who perform public attendance tasks in service centers where Electronic Forms Platform will be available. These can perform any task on the platform on behalf of the citizen, as well as examine and validate/disapprove the submitted forms.
- **Technician Manager:** Public Administration employees responsible for managing users with technician profile.
- **Manager:** Public Administration employees responsible for managing the platform. They have the task to maintain the forms provided and manage the FAQ list.
- **External Entity:** Information systems of Government sectors which provide its forms on the platform. These can consult the approved forms that concern its own department.

5. Development

This section describes the development of the solution proposed in the previous chapter. It lists the reasons for the choice of Scrum and presents the technological description of the development environment.

5.1. Scrum

The choose of Scrum was mainly due to the organization, discipline of execution and sharing of design vision that comes from its use, but also the improvement of the communication among members of the project team. With the Daily Scrums realization is possible to anticipate problems that otherwise would not be detected in time to be mitigated without further damage to the project.

5.2. Technology

5.2.1 Microsoft

The platform was developed in Visual Studio³, the Microsoft's IDE (Integrated Development Environment), using the .NET Framework. The portals were developed in ASP.NET MVC⁴, with C# for server-side code and Razor to generate HTML pages. The services layer was developed in Windows Communication Foundation⁵ (WCF), Microsoft's platform to develop service-oriented applications (SOA). The database is supported by Microsoft SQL Server⁶.

The choice for this development environment not only results from the constraints imposed by the client, but also is preferably used in Novabase in projects with this type of architecture.

5.2.2 Orbeon Forms

The chosen solution for supporting the creation and publication of electronic forms was the Orbeon Forms, described in Section 2. One of the features that allowed the inclusion of Orbeon Forms in the developed platform was this provide its applications in embedded mode. Result of

³<https://www.visualstudio.com>

⁴<http://www.asp.net/mvc>

⁵<https://msdn.microsoft.com/en-us/library/ms731082>

⁶<http://www.microsoft.com/en-us/server-cloud/products/sql-server>

this functionality it has been possible to integrate Form Builder and Form Runner in our platform in a transparent manner to the user.

The choice of Orbeon Forms is also due to constraints imposed by the client; however, due to its features and functionalities, it fits perfectly in the role it plays in the solution.

6. Conclusion

6.1. Contributions

The existence of information systems that serve the public services in developing countries is scarce, and Mozambique is no exception. Access to computers with internet connection is not a reality for most citizens in Mozambican society.

It is not unusual for a citizen to travel hundreds of kilometers to the provincial capital of their area to fill in a paper form, to deliver multiple copies of attached documentation in different offices or simply to get information about the progress of a process course in public services. Information on these processes is scattered and disorganized, causing congestion of services and serious difficulties in resolving any request.

Aware of this problem, the Mozambique Government has made efforts to modernize the public administration through a very significant investment in information technologies, thus seeking to overcome some of the diagnosed problems.

The work developed and presented in this thesis is in line with this intention, sure to help overcome some of these facts.

Through a platform that provides various Public Administration's forms on the internet, the Government offers a quality service at service centers, not only in urban areas but also in the rural provinces, thus minimizing the impact of the virtual absence of domestic computers with internet access.

The form filling functionality is accompanied by document scanning, improving the information organization and centralization. The processes will become more efficient and closer to the citizen.

6.2. Future Work

This section lists some features that although were not included in the project, they were highlighted

as capital gains for Electronics Platform Forms:

- **Authentication with electronic identification card:** Although Mozambican citizens do not own an identification document with authentication mechanisms, similar to the one existing in Portugal, the Government of Mozambique does not put aside the availability of this card in the near future.
- **Payment Module:** Much of the forms submitted to the public administration service centers require the payment of fees. An additional feature would be to create a payment module on the platform that would enable the payment of such fees during the form submission.
- **Application for Mobile Devices:** While the platform portals are accessible from mobile devices, these are optimized for access from personal computers.
- **SMS Notifications:** The possibility to notify citizens by SMS during the state change of a process on the platform. Process Status Inquiry by SMS – The possibility for a citizen to check the status of a process on the platform through SMS.

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