System of dissemination of Bivalve Consumption Safety Information

Gonçalo Vilela
Instituto Superior Técnico, Av. Rovisco Pais, 1049-001 Lisboa, Portugal
goncalo.vilela@tecnico.ulisboa.pt

***Abstract*— Bivalves are very present in the Portuguese gastronomy and considering that the contamination of bivalves can lead to serious health problems, it is necessary to ensure that the information regarding their contamination is disseminated in a clear and fast way. IPMA is responsible for monitoring and providing information on the contamination status of the production zones. In this way, basically IPMA provides a section on the website where is presented some information about this subject. There is also a Facebook page and an email list that aren't advertised online. The current IPMA system presents a set of problems from: sections on the website that do not work properly, difficulty in managing website content, most daily procedures are not automated and failure to take advantage of the mailing list and social networks. This work aims to improve IPMA's system of dissemination of information allowing a clearer and faster divulgation. Part of this improvement involves the automation of some procedures that will save time to the people responsible for them and provide new tools that will reduce the errors of the current system as well as improve the system itself. The results suggest that the tools created fit the current and future procedures of IPMA as well as have been well accepted. There are some features that need improvement before they are made available to the public.**

***Index Terms*— Bivalve, health, automation, dissemination.**

I. Introduction

Portugal has a vast coast that is an important part of the Portuguese economy and many of the food present in the Portuguese gastronomy comes from the coast. Bivalve molluscs are vulnerable to exposure to diverse marine toxins, metals and bacteria that can cause health problems to consumers. The risks to public health from the consumption of contaminated bivalves can range from amnesic poisoning (ASP) to diarrhetic poisoning (DSP) and paralytic poisoning (PSP) [1].

According to *Diário da República* (1.ª série-N.º 193-4 October 2014) [2], the entity responsible for monitoring the state of contamination of bivalve molluscs on the Portuguese coast is IPMA.

The list of the production areas of bivalve molluscs with de territorial delimitation and the existing species is available on *Despacho* nº1851/2017 from *Diário da República* [3].

The main means used by IPMA to inform people about the state of contamination of bivalve molluscs are a public website, a mailing list, a Facebook page and a general phone number. Until May of this year, the website had a map that did not show all the closures of the production areas which made impossible to know the state of these areas through the website. The mailing list and the Facebook page are not advertised online which reduces the audience. In addition to these problems, the daily processes are very time-consuming.

This work aims to improve IPMA's system of dissemination of information through the introduction of new functionalities. Allowing a clearer and faster divulgation.

II. State-of-the-art on dissemination and presentation of information

Nowadays, there are a lot of different technologies used for dissemination and presentation of information.

A. Websites

According to Internet Live Stats, there are more than four billion internet users and almost two billion websites [4]. For public health, websites have a significant importance since approximately 4.5% of all searches done on the web are health related, representing around 6.75 million searches per day [5].

B. Dashboards

Dashboards present results and statistics in an organized way using graphics and figures. Dashboards nowadays are already developed with technologies that allow them to be interactive and provide data in real time.

C. Email

One of the most commonly used ways to communicate is through e-mail, with more than 200 billion e-mails being sent per day [4].

D. IVR

According to ANACOM [6], the use of fixed telephone systems continues to increase in Portugal, reached 46.9 accesses per 100 habitants, this being the highest penetration rate recorded. One of the reasons for the total increase in accesses was the growth of VoIP.

There are some works developed in public health with positive results regarding the implementation of this type of system, such as in monitoring risk behaviors for people with HIV [7].

E. SMS

According to ANACOM [8], in Portugal despite the fact that in recent years occurred a decrease in the use of this service, the monthly average per user is 178 messages. Some of the

advantages of using this type of communication in health promotion are the low cost, popularity, convenience and great accessibility of this service [9].

F. Mobile applications

It is estimated that by 2021 about 40% of the world population will have a smartphone which gives these mobile applications a very important role in the dissemination of information [10]. In public health, several studies have already been carried out with positive results in the provision of health care [11] and in the distribution of information about available health services [12].

G. Social media

Worldwide in terms of active users, Facebook has more than two billion users, YouTube nearly two billion users, Instagram approximately one billion users and Twitter more than 300 million users [13]. In Portugal according to *Público* [14], the most used social networks are Facebook, YouTube, Google+, LinkedIn, Instagram and Twitter in this order with users spend an average of 81 minutes per day in this service.

According to Nina Bjerglund Anderson and Thomas Söderqvist [15], the use of social networks in public health has a number of advantages such as: free, flexible, has a rapid distribution, has a wide audience and is people-oriented. The disadvantages pointed out by the same authors are: lack of control, possibility of misuse and exposure to criticism.

H. Web services

According to Hugo Hass and Allen Brown [16], web services are software systems designed to support interoperable machine-to-machine interaction over a network. Web services are created based on two main principles: SOAP and REST. A summary of the comparison between REST and SOAP is presented in TABLE I and TABLE II.

TABLE I
COMPARISON BEETWEEN SOAP AND REST BASED ON SOME CRITERIA, ADAPTED FROM [17].

Criteria	SOAP vs REST
Lower effort (server side)	REST
Lower effort (client side)	SOAP
Lower code lines	SOAP
Higher execution speed	REST
Lower memory consumption	REST
Protocol independency	SOAP
Lower complexity	REST
High performance	REST
Efficiency	SOAP
Maintenance (server side)	REST
Maintenance (client side)	SOAP

TABLE II
EXAMPLE OF PROJECTS THAT FIT BETTER EACH PRINCIPLE BASED ON SOME CRITERIA, ADAPTED FROM [17].

	Criteria	Project examples
REST	Higher scalability	Integration between mobile apps and systems of information; Solution for simple exchange data between client and server;
	Compatibility	
	Performance	
	Simplicity	
	Communication model point to point	
SOAP	Higher security and reliability	Business information systems; Banking information systems; Payment systems;
	Lower number of errors	
	Asynchronous requests	
	Support for other standards (WSDL, WS)	

III. USERS AND FUNCTIONALITIES

This section describes the system requirements as well as the functionalities provided.

A. Users categories

There are different types of users that can be divided into categories according to their activity. The categories are:

- Producers: This type of user is a stationary one, considering nurseries are fixed in one place. It is important for this type of user to have access to the information about the status of the zones which his activity is established.
- Fishermen: Group of users involved in the capture of bivalve molluscs. It is crucial to this type of user to receive up-to-date information about the status of the production zones.
- Consumers: For these users is important that they know not only the state of interdiction but also to have easy access to relevant information about the consumption of contaminated bivalves.
- Commercial activities: Type of user that participates in bivalve sale activities.
- Food regulating authorities: Group of entities responsible for regulating the sale of food to consumers, an example of one of these entities is ASAE.
- IPMA's Administrators: IPMA personnel, qualified to manage the system.

B. *Functionalities*

For the creation of the functionalities, a survey was made to users of the current IPMA's system. The features that will be available by the new system are:

1) Microsite

To make available content only about bivalves, a microsite will be created. This microsite will have an organizational structure of a blog with sections about species, zones, news, legislation and others relevant subjects.

2) Interface admin

The system will provide an interface for administrators to add, change or delete database contents in a simple and intuitive way. Authentication by administrators is required to use this interface.

3) CMS

One of the problems of the current system is the difficulty that administrators have in placing and managing content of the website. A CMS will be created to provide an easy-to-use microsite administration interface.

4) Interactive map

The developed map will allow to consult the current state but also the history of the interdictions. To help the navigation through the map will be created filter sections and a timeline.

5) Download

The new system will provide the download of PDF files and Excel files.

6) API REST

An API REST will be created to provide access to other machines. The endpoints of the API will return in json only data related to bivalve molluscs.

7) Subscription of notifications

The system will allow the users to subscribe email notifications and choose the zones of interest.

8) Automation

To facilitate the daily procedures of IPMA personnel, the following processes will be automated as shown in Figure 1:

- Automatic page creation
- Automatic creation of the content of the microsite
- Send notifications automatically
- Automatic document generation

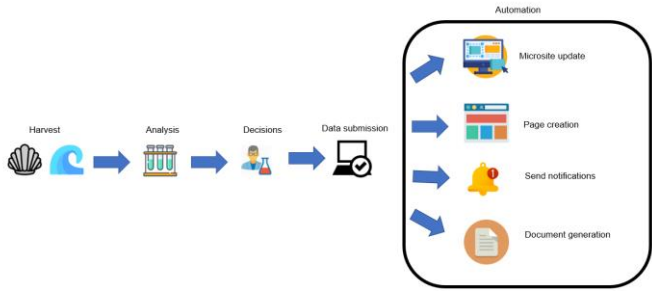

Fig. 1 Automations provided by the new system.

IV. Architecture and Implementation

This section describes the system architecture as well as some details about the implementation of the functionalities provided.

A. *Architecture*

The simplified architecture of the new system is presented in Figure 2. There will be a GUI for authenticated administrators, trough which they can make changes to the microsite and to the database. Most of the functionalities of the system will be created using APIs and the communication with the server will be done through web services. The microsite communicates directly with the API created and the server for the presentation of its content.

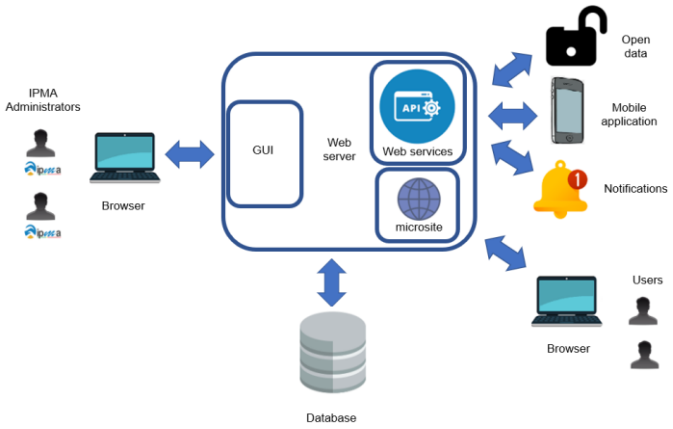

Fig. 2 Simplified system architecture.

B. *Implementation details*

In this section will be presented some details about the implementation of the functionalities.

1) Microsite

For the creation of the microsite, simple Bootstrap templates were used. The communication between the templates and the back end is done through Django views and the context method of the Wagtail models.

2) Interface admin

The interface for administrators to make changes to the database is the admin interface provided by Django. This interface has been customized to make it easier to use.

3) CMS

The interface for administrators to make changes to the microsite is the admin interface provided by Wagtail. This interface has been customized to make it easier to use.

4) Interactive map

To create the map and the timeline were used the Leaflet library and the vis.js library respectively. The data available in the map and in the timeline is obtained using some of the endpoints provided by the API REST developed.

5) Download

This functionality provides the download of pdf files and excel files. Both types of file are generated automatically in the *microsite*. For the generation of pdf files were used the library Report Lab and Django views. For the generation of the excel files were used the library django-import-export and Django views.

6) API REST

For the development of the REST API was used the Django REST Framework to serialize the Django models. The endpoints created are:

- api/species – Returns the list of species.

- api/species/<scientific name> – Returns information about the indicated specie.
- api/species/<scientific name>/zones – Returns a list of zones where the indicated specie exists.
- api/zones – Return the list of zones
- api/zones/<code> – Returns information about the indicated zone.
- api/zones/<code>/species – Returns a list of species that exist in the indicated zone.
- api/closures – Returns the interdiction status of the zones for a specific date.
- api/analysis – Returns the types of analysis.
- api/analysis/microbiology/results – Returns the latest results of microbiology analysis.
- api/analysis/metal/results – Returns the latest results of metals analysis.
- api/analysis/biotoxin/results – Returns the latest results of biotoxins analysis.
- api/analysis/phytoplankton/results – Returns the latest results of phytoplankton analysis.
- api/harvests – Returns a list of harvests for a specific date.

7) Subscription of notifications

The subscription of notifications was created using Django forms and Django views.

8) Automation

For the development of the automations were used:

- Social media APIs: used in the integration of Facebook, twitter and email.
- Django models save method: used to create automatically wagtail pages.
- Save method of wagtail pages: used to send notifications.
- Context method of wagtail pages: used to generate automatic menus.
- API REST endpoints: used to display automatic content in the microsite.

V. EVALUATION

This section presents the summary of the results obtained during the evaluation of the system. The evaluation is divided in two phases: Survey to administrators and survey to the users.

A. Interview to administrators

In this interview, questions were asked about the ease of use and the compatibility of the developed functionalities with the present and future of IPMA. This survey is divided in four sections: Django admin interface, Wagtail admin interface, Notifications, Documents and Procedures.

The only negative results obtained in this survey were related to the management of the geographic content of the database through the Django admin interface.

B. Survey to the users

This survey is divided in six sections: microsite strategy, microsite usability, microsite design, map, API, notifications. This survey was attended by 25 users.

1) Microsite strategy

In this section of the survey, were asked questions about the importance of the existence of the microsite. The results are shown in Figure 3, where 5 represents very important and 1 not important.

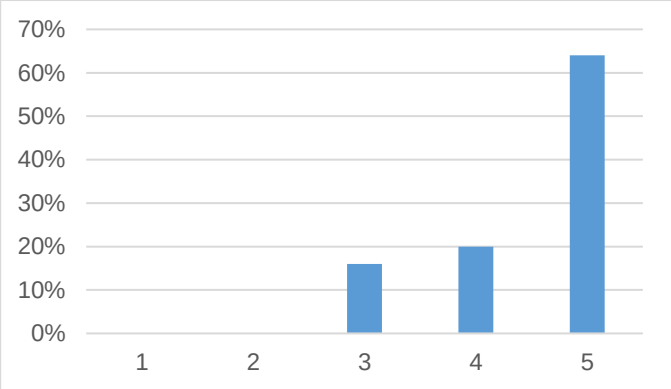

Fig. 3 Importance of the microsite for the users

2) Microsite usability

In this section of the survey, were asked questions about the usability of the microsite. The results are shown in Figure 4, where 5 represents very good and 1 very bad.

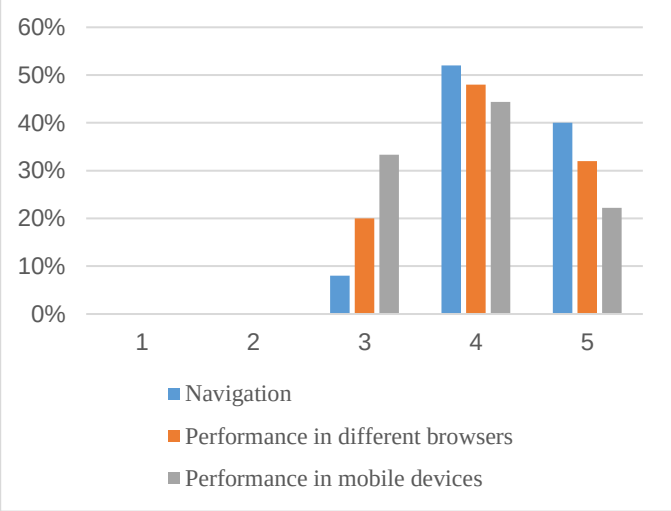

Fig. 4 Microsite usability in terms of navigation and performance

3) Microsite design

In this section of the survey, were asked questions about the microsite design in terms of presentation, organization, consistency and content easy to find. The results are shown in Figure 5, where 5 represents very good and 1 very bad.

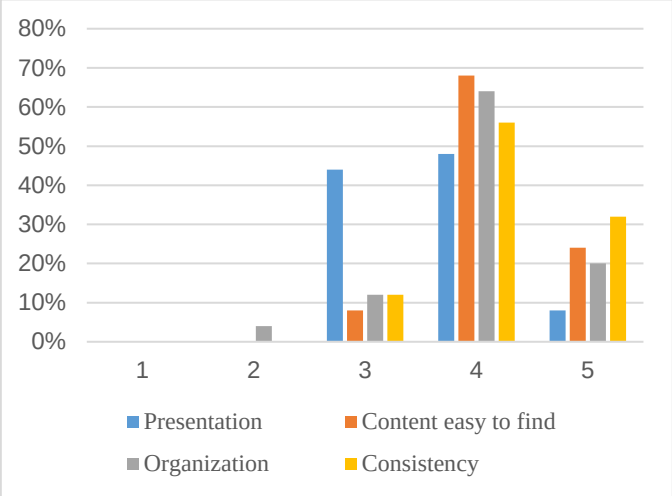

Fig. 5 Results about the design of the microsite.

4) Map

In this section of the survey, were asked questions about the importance of the functionalities provided by the map section of the microsite. The results are shown in Figure 6, where 5 represents very important and 1 not important.

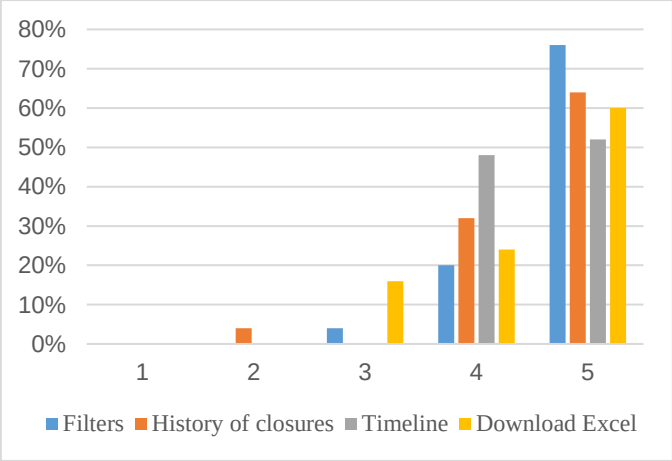

Fig. 6 Importance of the functionalities of the map

5) API

In this section of the survey, were asked questions about the importance of the existence of the API REST developed. The results are shown in Figure 7, where 5 represents very important and 1 not important.

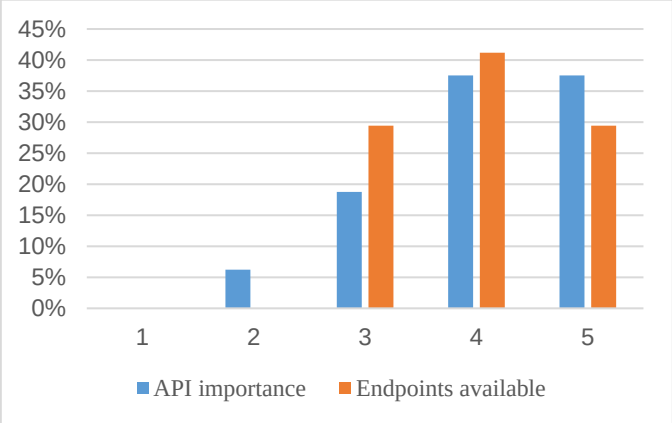

Fig. 7 Importance of the API and the endpoints

6) Notifications

In this section of the survey, were asked questions about the importance of the functionalities related to social media. The results are shown in Figure 8, where 5 represents very important and 1 not important.

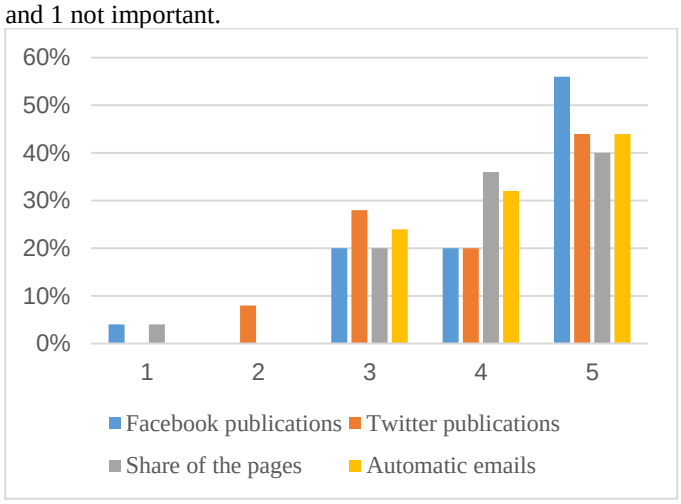

Fig. 8 Results about social media functionalities

VI. Conclusion

The main objective of this work was the creation of an information dissemination system that offer a set of functionalities that aren´t available in the current system. This goal was achieved, however, there are a set of features that are not fit yet to go public.

It is necessary for the administrators to define the structure of the content that will be inserted in the sections of the microsite as well as the prototype of the content that the notifications in each situation must have.

The interfaces for administrators present in general terms a good ease of use and adequacy to current and future IPMA procedures.

A set of functionalities have been made available in the microsite that do not exist in the current system like an interactive map that allows the navigation in time, the download in different formats, a REST API, the subscription of email notifications to certain zones of interest as well as the automation of daily procedures.

There are some improvements that need to be made before entering the production phase: improvement of the microsite design, improvement of the automated content of the publications, improvement of the load of zones geometry in the Map Page template, improvement of mobile devices performance and improvement of the interface for Django administrators with respect to geographic data management of the models.

Acknowledgements

I would like to thank Prof. João Nuno Oliveira e Silva for his support and counseling during the development of this work. I would also like to thank Dr. Mafalda Carapuço, Mr. Rui Oliveira and Mrs. Carolina Magro from IPMA for the availability and help during this project.

REFERENCES

[1] DGS, “Biotoxinas Marinhas,” *Direção-Geral da Saúde*. [Online]. Available: https://www.dgs.pt/paginas-de-sistema/saude-de-a-a-z/moluscos-bivalves.aspx. [Accessed: 23-Sep-2018].

[2] DRE, “Portaria n.º 304/2012,” *Diário da República n.º 193/2012, Série I de 2012-10-04*, 2012. [Online]. Available: https://dre.pt/web/guest/pesquisa/-/search/175565/details/normal?q=ESTATUTOS+DO+INSTITUTO+PORTUGUÊS+DO+MAR+E+DA+ATMOSFERA+2012.

[3] DRE, “Despacho n.º 1851/2017,” *Diário da República n.º 45/2017, Série II de 2017-03-03*, 2017. [Online]. Available: https://dre.pt/home/-/dre/106547099/details/maximized?serie=II&parte_filter=31&day=2017-03-03&date=2017-03-01&dreId=106547088.

[4] Internet Live Stats, “Internet Usage & Social Media Statistics.” [Online]. Available: https://www.internetlivestats.com/. [Accessed: 25-Sep-2018].

[5] D. Tao, C. M. LeRouge, G. Deckard, and G. De Leo, “Consumer perspectives on quality attributes in evaluating health websites,” in *45th Annual Hawaii International Conference on System Sciences*, 2012.

[6] ANACOM, “Serviço telefónico fixo 2017.” [Online]. Available: https://www.anacom.pt/render.jsp?contentId=1430731%0D. [Accessed: 25-Sep-2018].

[7] J. A. Tucker, E. R. Blum, L. Xie, D. L. Roth, and C. A. Simpson, “Interactive voice response self-monitoring to assess risk behaviors in rural substance users living with HIV/AIDS,” *AIDS Behav.*, 2012.

[8] ANACOM, “Serviços móveis 2017.” [Online]. Available: https://www.anacom.pt/render.jsp?contentId=1433877. [Accessed: 25-Sep-2018].

[9] M. S. C. Lim, J. S. Hocking, M. E. Hellard, and C. K. Aitken, “SMS STI: A review of the uses of mobile phone text messaging in sexual health,” *International Journal of STD and AIDS*. 2008.

[10] Statista, “Smartphones industry: Statistics & Facts.” [Online]. Available: https://www.statista.com/topics/840/smartphones/. [Accessed: 25-Sep-2018].

[11] R. A. R. and S. A. A. Banerjee, “Mobile Health Monitoring: Development and Implementation of an App in a Diabetes and Hypertension Clinic,” in *2016 49th Hawaii International Conference on System Sciences (HICSS)*, 2016, pp. 3424–3436.

[12] A. Imteaj and M. K. Hossain, “A smartphone based application to improve the health care system of Bangladesh,” in *2016 International Conference on Medical Engineering, Health Informatics and Technology (MediTec)*, 2016, pp. 1–6.

[13] Statista, “Global social media ranking 2018.” [Online]. Available: https://www.statista.com/statistics/272014/global-social-networks-ranked-by-number-of-users/. [Accessed: 25-Sep-2018].

[14] Público, “Uso das redes sociais em Portugal triplicou em sete anos.” [Online]. Available: https://www.publico.pt/2016/06/29/p3/noticia/uso-das-redes-sociais-em-portugal-triplicou-em-sete-anos-1826157. [Accessed: 25-Sep-2018].

[15] Nina Bjerglund Anderson e Thomas Söderqvist, “Social Media and Public Health Research,” Faculty of Science University of Copenhagen, 2012.

[16] Hugo Haas and Allen Brown, “Web Services Glossary,” *W3C Working Group Note 11 February 2004*. [Online]. Available: https://www.w3.org/TR/ws-gloss/. [Accessed: 25-Sep-2018].

[17] J. Tihomirovs and J. Grabis, “Comparison of SOAP and REST Based Web Services Using Software Evaluation Metrics,” *Inf. Technol. Manag. Sci.*, 2016.