Artícle **Journal of Technological Development**
December 2022, Vol.6 No.18 1-11

Data analytics in the management of avocado export certificates

Analítica de datos en la gestión de certificados de exportación de aguacate

OCHOA-ORNELAS, Raquel†*, VARGAS-DUEÑAS, Annet and FIGUEROA-MILLÁN, Patricia Elizabeth

Tecnológico Nacional de México - Instituto Tecnológico de Ciudad Guzmán, México.
Tecnológico Nacional de México - Instituto Tecnológico de Colima, México.

ID 1st Author: *Raquel, Ochoa-Ornelas* / **ORC ID:** 0000-0003-1824-5789, **Researcher ID Thomson:** S-4687-2018, **arXiv Author ID:** Raquel Ochoa, **SNI CONACYT ID:** 668976

ID 1st Co-author: *Annet, Vargas-Dueñas* / **ORC ID:** 0000-0003-1825-0959, **arXiv Author ID:** annet_vargas

ID 2nd Co-author: *Patricia Elizabeth, Figueroa-Millán* / **ORC ID:** 0000-0001-7562-7578, **Researcher ID Thomson:** GRX-4871-2022, **SNI CONACYT ID:** 237559

DOI: 10.35429/JTD.2022.18.6.1.11 Received July 10, 2022; Accepted December 30, 2022

Abstract

When issuing avocado export certificates, a high volume of data is generated. Consequently, its analysis is complex due to processing times. This paper presents a Web platform that can analyze and process sequences and comparative statistics with projections during the management of these certificates. During the development phase, interviews were conducted with users to gather the requirements by the Jalisco Avocado Growers and Exporters Association (APEAJAL), through a formal specification using the Unified Modeling Language (UML). Programming languages for coding such as Android Studio, PHP, JavaScript, HTML5, AJAX, jQuery, Bootstrap and MySQL were used. This project provides support for decision-making processes, favoring strategies in the association's senior management, contributing significantly to offering a reliable platform for the registration and monitoring of certificates.

Platform, Analysis, Data, Export, Projections, Strategies

Resumen

Al emitir certificados de exportación de aguacate se genera un alto volumen de datos. En consecuencia, su análisis es complejo debido a los tiempos de procesamiento. En este trabajo se presenta una plataforma Web que tiene la capacidad de analizar y procesar secuencias y estadísticas comparativas con proyecciones durante la gestión de estos certificados. Para el desarrollo, se realizaron entrevistas con los usuarios para recabar los requerimientos por parte de la Asociación de Productores Exportadores de Aguacate de Jalisco A.C. (APEAJAL), a través de una especificación formal por medio del Lenguaje Unificado de Modelado (UML). Se emplearon lenguajes de programación para la codificación como Android Studio, PHP, JavaScript, HTML5, AJAX, jQuery, Bootstrap y MySQL. Ese proyecto brinda apoyo a los procesos de toma de decisiones, favoreciendo estrategias en la alta dirección de la asociación, contribuyendo significativamente en ofrecer una plataforma confiable para el registro y seguimiento de certificados**.**

Plataforma, Análisis, Datos, Exportación, Proyecciones, Estrategias

Citation: OCHOA-ORNELAS, Raquel, VARGAS-DUEÑAS, Annet and FIGUEROA-MILLÁN, Patricia Elizabeth. Data analytics in the management of avocado export certificates. Journal of Technological Development. 2022. 6-18:1-11.

* Correspondence to Author (Email: raquel.oo@cdguzman.tecnm.mx)
† Researcher contributing first author.

Introduction

The avocado industry has grown internationally due to the rising market and consumption demand in America, Europe, and Asia, improving production and industrialization in areas capable for its cultivation. The main countries dedicated to avocado production are Mexico, Guatemala, Peru, Israel, the United States, Spain, South Africa, and Australia (Solís, 2022). Mexico is considered one of the main countries that cover demand avocado in Canada and the United States during the months of October to January (Cánepa et al., 2022). On the other hand, the European Union is one of the most important avocado export markets in Latin America, however, the European Green Deal represents a challenge to an ecological economy associated with greater safety and security control, which promotes greater competitiveness, generating challenges in different producing countries to enter this market (Collaguazo, 2022). The COVID-19 pandemic has adversely affected the food sector, because of this 85% of Mexican exporting companies established plans and implemented export strategies (Ramos et al., 2022). Moreover, the agricultural sector is one of the most affected by globalization, rising the costs of inputs and services without exclude financial services. In Mexico, bank financing has been affected by climate risk, as well as by the uncertainty in the legal environment. In addition, there is a culture of individual production, added to the fact that financial credits in the agricultural sector are established in long term, increasing the uncertainty in projects (Magallán, 2022).

Information systems play an important role in companies, since in addition to requiring processes and transactions to be carried out efficiently with suppliers and customers, it is essential to maintain competitiveness in the market with timely and accurate decisions. These store and manage data producing reports, enhancing databases over time for later access to accurate knowledge, which is made available to managers to establish strategies and make decisions (Araya et al., 2019). Currently, this data is generated massively, making it difficult to process and analyze, requiring the intervention of emerging technologies such as Big Data.

Big Data is present in the global economy and in different sectors, generating intelligence for organizations through the analysis of massive data that includes three important properties: volume, variety, and speed. The last property is related to the speed in generating and transmitting data through technologies and tools, models, and data analysis techniques, providing knowledge for decision making. From an analytics approach, data management includes retrieving, storing, analyzing, and displaying the results. Therefore, it is essential to integrate engineering principles so that the organization manages the flow of its data for subsequent analysis that generates results dynamically. Data engineering is responsible for the generation, collection, and storage. While data analysis includes the generation of mathematical and statistical models, implementation, and visualization (Rossi & Hirama, 2022).

This applied research is focused on the development and implementation of a computer platform in a Web environment at an administrative and managerial level that facilitates the processes in the acquisition, analysis, and comparative statistics of data from export certificates that are granted to avocado packing companies. Considering the above, at this administrative level monitoring and control functions are identified that require a strategic planning tool to examine opportunities that serve as a basis for decision-making (Araya et al., 2019). The developed platform allows the database to be consolidated in each operation or transaction that is registered to subsequently generate knowledge through data analytics, resulting in comparative statistics of production by seasons in the different periods. In addition, it incorporates the consultation and statistics section in a mobile application available to the directors of the association so that they have access to this information at any time.

Theoretical framework

Information systems

The most valuable asset for companies is to have immediately, accurate information, since it allows knowing the context of the horizon and situation, identifying opportunities to establish strategies and improvements (Carrillo et al., 2019).

ISSN 2531-2960

Information systems have evolved in recent years, covering user information requirements at the managerial level, acquiring greater complexity and commitment to the use of external information. The information is integrated into a corporative strategy, using current information technologies that allow competition and business growth based on support instruments that company managers require for assertive decision-making (de Pablos et al., 2019). Information systems in small and medium-sized companies represent a useful tool for their operational development and analysis of their situation, since they facilitate data acquisition and processing, as well as Systems must to adjust to the requirements of different users and levels of the organization.
(Cordero, et al., 2020).

Systems must adjust to the requirements of the different users and levels of the organization. Different levels are identified in management information systems, some focused on storing and processing data and others on monitoring and control. Management-level systems generate regular reports that relate to the periodic operations that are carried out. Transaction processing systems track the internal and external operations carried out by the company. Management systems are classified into decision support systems and management systems. As a functional perspective, support systems are contemplated in senior management whose purpose is to determine a forecast of trends. In middle management the interest is on the analysis of reports and in operational management the attention is focused on the processing of operations and transactions (Araya et al., 2019).

Carrillo et al. (2019) mention that the term Business Intelligence (BI) was used since 1958 by Hans Peter Luhn, defined as "collection and use of knowledge based on facts in order to improve business strategy and tactical sales in the market". In the 1960s and 1970s, when the first database applications emerged, there was a lack of adequate technologies for accessing and processing them. They consider BI as the set of techniques to integrate data for its exploitation, in order to acquire useful information to detect opportunities or problems based on the analysis of historical data, making comparisons, obtaining reports through an appropriate format and later the knowledge to alert atypical events or set strategies.

Intelligent business systems integrate BI tools that organize data to manage knowledge with analytical instruments. BI saves time to locate information of managerial interest and to generate graphics in a short time. It allows establishing goals by comparing historical and current financial results or those of other companies, generating future projections. The preparation of the data includes the ETL component (extraction transformation and loading). Extraction process retrieves information related to the problem. Meanwhile, transformation process involves placing the extracted information in a specific format. Finally, the load process refers to the knowledge that is obtained when processing and analyzing the data (Cordero, et al., 2020). Rossi & Hirama, (2022) explain that preprocessing with algorithms should be considered to eliminate noise, dirt or biases that may hinder the analysis. Other similar concepts are considered such as data mining, OLAP (online analytical processing), data warehouse, data mart (subset of data from a business line), reports, among others (Carrillo et al., 2019).

UML

UML describes the behavior and structure of a business system or process. It is implemented in the 1990s by Grady Booch, Ivar Jacobson, and James Rumbaugh to represent software development in a standard way. The main advantages are that it simplifies complexity, increasing the quality of work, reducing costs and time, keeping open communication between developers and users. UML diagrams are classified into structure diagrams and behavior diagrams to represent different types of scenarios (Microsoft, 2019).

MySQL

MySQL emerged in the 1990s as a relational database manager for simple Web projects, however, it gained strength with good performance on low-processing servers. In addition, it is stable and free and offers different communication protocols between the client and server, both locally and in a remote client. There are some variants of MySQL such as MariaDB that emerged in 2009 as an alternative to the Oracle version (Combaudon, 2018).

ISSN 2531-2960

PHP

Arias (2017) defines PHP as Hypertext Pre-Processor. It is an interpreted language that is considered among the first for the insertion of HTML documents, freely used for applications on the server side with dynamic content on the World Wide Web. PHP is used in applications from MediaWiki, Facebook, Drupal, Joomla, WordPress, among others. It appears for the first time in 1994, when Rasmus Lerdof creates a package of CGI programs to replace the Perl script, with the name of Personal Home Page.

JavaScript

Pérez (2019) states that in the 1990s the Internet connection reached a speed of up to 28.8 kbps and forms began to be included in increasingly complex applications. If the form was captured incorrectly, it was necessary to wait for the response from the server to display the errors. In 1995 programmer Brendan Eich solved the problem with existing technologies in the Netscape Navigator 2.0 browser, calling the LiveScript language. Netscape later signs a contract with Sun Microsystem to change the name to JavaScript, which was already built into Netscape Navigator 3.0. For its part, Microsoft releases JScript in the Internet Explorer 3 browser. Netscape standardized the language to JavaScript in 1997 by submitting the JavaScript 1.1 specification to the European Computer Manufacturers Association (ECMA), which named ECMAScript to refer to JavaScript.

Luna (2019) comments that JavaScript is an interpreted, typed, dynamic and object-oriented programming language. It is based on the C language, and in the latest versions, the language runs on both the client and server sides. Currently, it is integrated into the main navigation engines. JavaScript code can be embedded inside the HTML in the <script> tag, or outside the HTML by using an external file with a JS extension to embed it in the HTML in the src attribute of the <script>. It is also possible to use JavaScript through the console in Google Chrome from the developer tools.

AJAX

Castillo (2017) states that AJAX is the acronym for AsynchronousJavaScript and XML created by Jesse James Garrett in 2005, while the XMLHttpRequest object was introduced by Microsoft in 1999. AJAX is integrated into the Javascript language and allows requests to be made to the server without delay. to reload the HTML page. In the first versions, the XMLHttpRequest object was used, which included an onreadystateschange event handler.

jQuery

Parada (2019) defines jQuery as a JavaScript library that was created by John Resig in 2006 and that adds an AJAX interaction layer to handle events in Web applications. jQuery is free and open-source software that makes it easy to access and select Document Object Model (DOM) elements by offering plug-ins to developers through low-level animation and interaction abstractions and high-level advanced effects by generating code simplified compared to code with just JavaScript. It also allows you to develop complex scripts to validate forms before they are sent. Boduch, et al. (2017) comment that the jQuey library offers a general-purpose abstraction layer for Web scripts allowing to access the elements of a document, alter the content or appearance of the Web page, respond to user interaction, as well as display the change being made by retrieving information from the server without the need to refresh the page.

JSON

Afsari et al. (2017) defines JavaScript Object Notation (JSON) as a more efficient data exchange format than Extensible Markup Language (XML) using AJAX. Sourd (2022) explains that JSON was created by Douglas Crockford in 2002 as an alternative to XML and defines JSON as the representation of a lightweight format designed to exchange data, since it reduces the volume of data and consequently the size of the files to transmit. The format represents a subset of the JavaScript syntax, allowing JSON definitions to be accessed without any additional parsing.

ISSN 2531-2960

Zhou (2022) explains that JSON supports two types of structures, the object structure as key-value pairs separated by a comma and enclosed in {}, and the array structure of a set of multiple values. It also comments that to retrieve data, the string must be converted to a native JavaScript object, as it has a global JSON object with conversion methods. It is widely used in data mining. You can easily and quickly exchange data between applications developed in different languages. On Android, an application can interact with a database installed on a Web server, using the JSON format.

Bootstrap

Mercy (2019) explains that the Bootstrap library is made up of various components such as Accordion, Alert, Buttons, Carousel, Collapse, DataPicker, Modal, ToolTip, among others. These components contain properties and functionality that can be replicated in Web application development. Logrono et al. (2020) consider Bootstrap as an agile work environment in Web development. Ortega et al. (2019) explain that Bootstrap was developed by Mark Otto and Jacob Thornton, who also developed Twitter. It was created to drive consistency and speed up project development. In 2012 the first version of Bootstrap was released by Twitter as open source, under the "Apache 2 License" copyright 2013 Twitter. The library considers four types of grids for different resolutions, automatically adjusting the columns to the device. It includes style sheets that allow to give uniformity and good appearance to HTML elements, also containing reusable components and plugins based on JavaScript jQuery.

Android studio

In 2005, Google acquired Android Inc., a company dedicated to the production of mobile applications. Subsequently, the mobile-optimised Java virtual machine (Dalvik VM) was created. The Open Handset Alliance consortium was formed in 2007 by Google, Intel, Texas Instrument, Motorola, T-Mobile, Samsung, among others, with the aim of developing open standards for mobiles. Android consists of a Linux kernel, native libraries (System C Library, Media Framework Surface Manager, WebKt/Chromium, SGL, 3D libraries, Free Type, SQLite, SSL), the Dalvik or ART virtual machine with Core libraries, application environment (Views, Resource Manager, Activity Manager, Notification Manager, Content Providers) and applications (Gironés, 2019). The Android Studio Chipmunk version is available from 2021 (Android Studio, 2022).

2.11 Volley

Lachgar et al. (2018) states that Android applications uses a REST API (Representational State Transfer) to transfer data on the Web, in order to create, publish and consume Web services through JSON. Volley is one of the most widely used libraries for accessing Web REST APIs. This API is considered as an HTTP library created by Ficus Kirkpatrick at Google IO in 2013, allowing the execution of asynchronous, synchronous, simultaneous, ordered, and prioritized requests. In Figure 1 the Volley architecture is presented.

ISSN 2531-2960

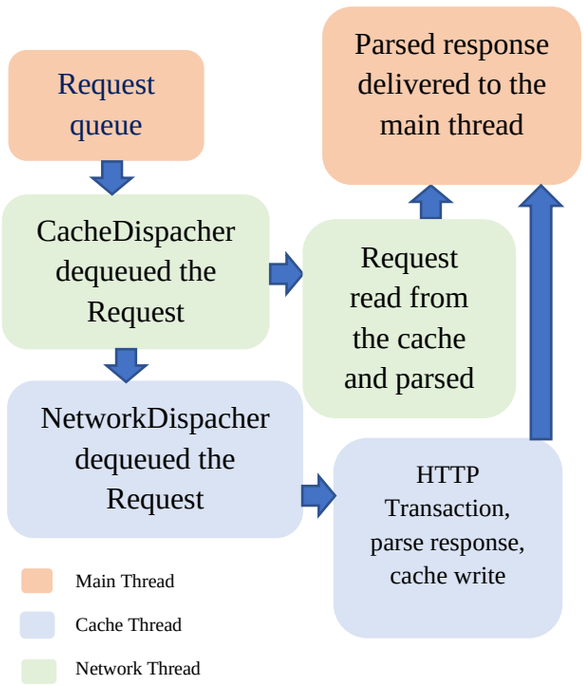

Figure 1 Volley architecture
Source: Lachgar et al. (2018)

Graph.js

Collaguazo et al. (2022) describe that the chart.js library is an open source tool that allows graph generation with filters and intuitive interactions since it has different presentations as bars, linear, pie, among others. It allows viewing metrics of interest in Web applications through the generation of Web services and the JSON format for the transfer of client and server data, to generate reports and establish timely actions.

MPAndroidChart

It is the most widely used graphics library in Android application development. It is integrated via dependency declarations in the project's Gradle build file, which allows the library to be included in the project. There are several documented guides available for implementation, including line charts, bar charts, column stacked bar charts, and others. It also includes scatter plots. It is required to configure styles, colors, and animations, as well as to contextualize the graph with labels. The library contains two layers: presentation and data. The presentation layer refers to the configuration of the view. The data layer provides a set of data that can be modified or updated and that generates the inputs to implement the graph. When data is updated, MP Android Chart is notified via the notify Dataset Changed and invalidate methods.

The separation between the layers allows dynamically update of graphics (Amarkumar Joshi, 2021).

Methodology

The project development was performed based on an incremental methodology, offers functionalities and improvements to the user until the implementation of the software product. During the process, the following phases that are repeated cyclically were attended:

1. Planning and requirements: The business model must define the way in which the data is integrated into the solution, as well as its acquisition, pre-processing, cleaning, processing, and presentation of results (Rossi & Hirama, 2022). Identify the problem to know the flow of the operational process and thus capture the requirements of the association, channel a proposal or strategy to solve the problem and prioritize the processes according to the arguments of those responsible for each area.

2. Analysis: Inspect data inputs, outputs, formats, policies, user levels, as well as establish the logic of the project. Figure 2 shows the general use case diagram of the Web platform.

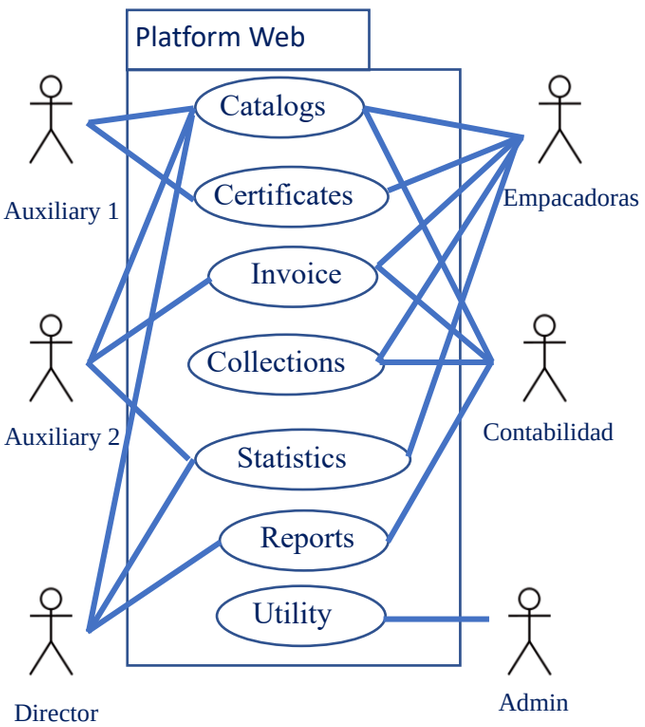

Figure 2 General use case diagram

ISSN 2531-2960

Figure 3 shows the usage diagram of the project in its two scenarios, Web application and mobile application.

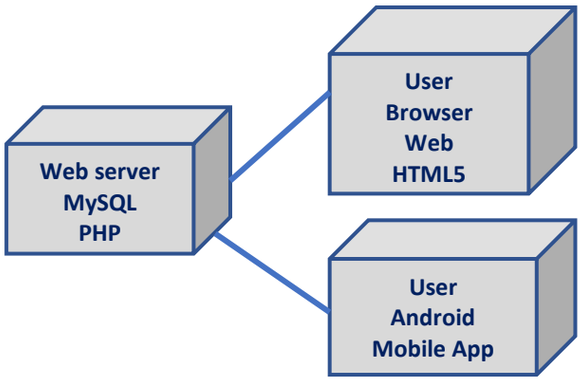

Figure 3 Implementation diagram

3. Design: Create the class diagram and generate the database in MySQL. Design the interfaces and reports for each use case for both the Web application and the mobile application.

4. Implementation: Codify each component of the platform, generating the connection to the database through PHP, JavaScript code implementation to define events and functions with AJAX and jQuery that allow maintaining usable and asynchronous interfaces during capture. Develop the application in Android Studio with connection to the database for the visualization of different queries and statistics.

5. Testing: Perform test cases for each of the components, detect failures and defects for error correction.

6. Implementation: Install the platform on a server in the cloud, performing integration tests.

Results

As a result, a mobile application and a Web platform were developed in order to allow the capture, validation, and monitoring of avocado export processes. Below are views of its development and implementation.

Figure 4 shows the mobile application login.

Figure 4 Mobile application login

Figure 5 shows the options of the mobile application, which consist of agendas for packers and suppliers in addition with a section for querying statistics.

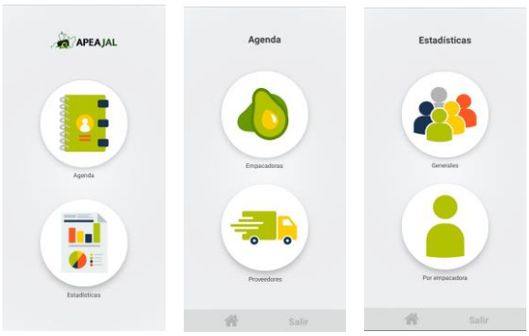

Figure 5 General application options

The information presented in the subsequent figures is obtained through a test data source for the validation of the different statistics. Figure 6 shows the historical and monthly statistics, both overall and by packer.

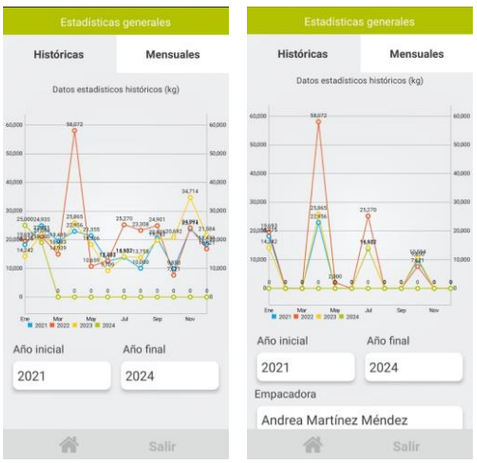

Figure 6 General statistics and by packer

Figure 7 displays the historical and monthly statistics in general bar format and by packer.

Figure 7 General monthly statistics and by packer

Figure 8 shows the historical export statistics obtained through the Web application.

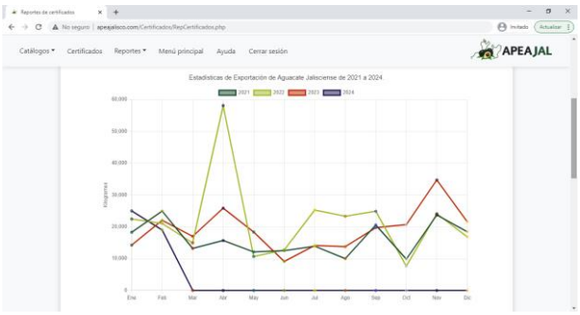

Figure 8 Historical export statistics

Figure 9 shows the historical export statistics in bar graphs.

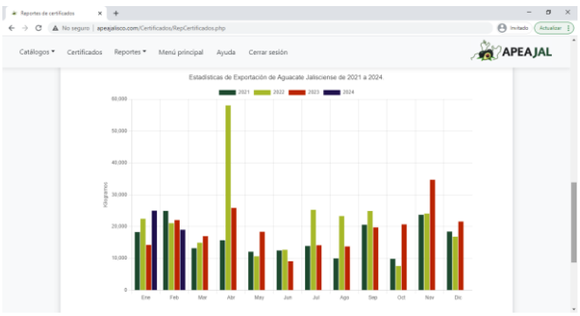

Figure 9 Historical export statistics

Figure 10 shows the monthly export statistics in bar graphs.

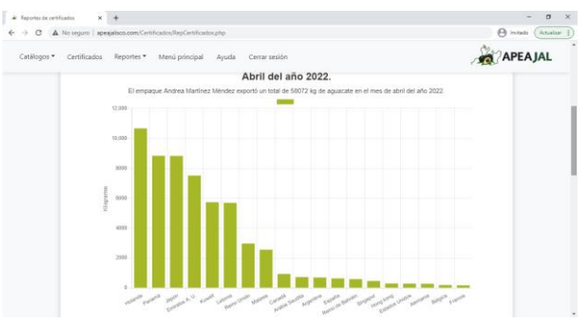

Figure 10 Monthly export statistics

Figure 11 presents a PDF report generated through the Web application.

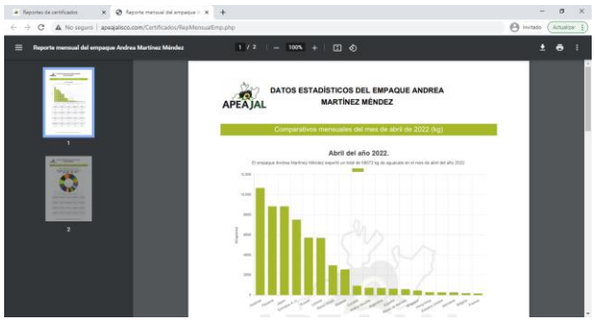

Figure 11 Monthly statistics pdf report

Figure 12 displays a comparative statistic by season in a range of years.

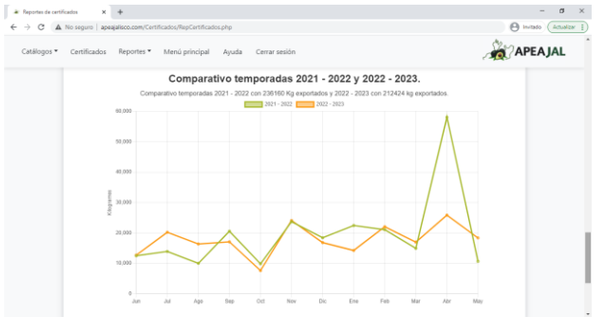

Figure 12 Comparative by season

Acknowledgements

This work has been funded by TECNM [15269.22-P].

Conclusions

Analytical engineering allows monitoring the processes of the company and acquire knowledge about its its direction, supporting management levels in strategic planning and decision making. The developed platform required analysis and design to cover each one of the requirements demanded by the different areas of the association, considering the enormous amount of data that can be generated during the avocado export processes. The project allows directors to understand what is happening in each of the areas and work together to achieve goals, providing support in decision-making processes, favoring the generation of future marketing and commercialization strategies.

ISSN 2531-2960

Future work

Analytical engineering optimizes times by improving strategies, considering the data generated inside and outside organizations, to enhance competitiveness. Historical data is available in Excel sheets collected since 2016, which will allow linear regression tests to be carried out with Machine Learning algorithm models and Neural Networks to select the model that best suits the association.

References

Afsari, K., Eastman, C. M., & Castro-Lacouture, D. (2017). JavaScript Object Notation (JSON) data serialization for IFC schema in Web-based BIM data exchange. *Automation in Construction*, *77*, 24-51. URL: https://www.sciencedirect.com/science/article/abs/pii/S0926580517300316 DOI: https://doi.org/10.1016/j.autcon.2017.01.011

Amarkumar Joshi, I. (2021). Unblind the charts: Towards Making Interactive Charts Accessible in Android Applications. *arXiv e-prints*, arXiv-2109. URL: https://arxiv.org/abs/2109.12442 DOI: https://doi.org/10.48550/arXiv.2109.12442

Android Studio (2022). ANDROID STUDIO. Recuperado el 11 de septiembre de 2022 de https://developer.android.com/studio

Araya-Guzmán, S. A., Hernández-Uribe, G., & Ramírez-Correa, P. E. (2019). Alineación entre Sistemas de Información, Tecnologías de la de Información y el Negocio: un Estudio Empírico en la Región de Biobío, Chile. *Información tecnológica*, *30*(5), 131-138. URL: https://www.scielo.cl/scielo.php?pid=S0718-07642019000500131&script=sci_arttext DOI: http://dx.doi.org/10.4067/S0718-07642019000500131

Arias, M. Á. (2017). *Aprende Programación Web con PHP y MySQL: 2ª Edicion*. IT campus Academy. URL: https://books.google.es/books?hl=es&lr=&id=mP00DgAAQBAJ&oi=fnd&pg=PA13&dq=Arias,+M.+%C3%81.+(2017).+Aprende+Programacion+Web+con+PHP+y+MySQL:+2%C2%AA+Edicion.+IT+campus+Academy.&ots=DMQloycQjX&sig=EhHRqdKpSWUHHYG6x27_55qruLo#v=onepage&q=Arias%2C%20M.%20%C3%81.%20(2017).%20Aprende%20Programacion%20Web%20con%20PHP%20y%20MySQL%3A%202%C2%AA%20Edicion.%20IT%20campus%20Academy.&f=false

Boduch, A., Chaffer, J., & Swedberg, K. (2017). *Learning JQuery 3*. Packt Publishing Ltd. URL: https://books.google.es/books?hl=es&lr=&id=vHc5DwAAQBAJ&oi=fnd&pg=PP1&dq=Boduch,+A.,+Chaffer,+J.,+%26+Swedberg,+K.+(2017).+Learning+JQuery+3.+Packt+Publishing+Ltd.&ots=lObhPmdfG1&sig=bmHsfhGjJbkRuQuNMie0kKHntdg#v=onepage&q&f=false

Carrillo, H. Z., Torres, N. N., & Huérfano, D. R. B. (2019). Nociones, consideraciones y ventajas de la inteligencia de negocios BI. *Revista vínculos*, *16*(2), 280-287. URL: https://geox.udistrital.edu.co/index.php/vinculos/article/view/15592 DOI: https://doi.org/10.14483/2322939X.15592

Castillo, A. A. (2017). *Curso de Programación Web: JavaScript, Ajax y jQuery*. IT Campus Academy. URL: https://books.google.es/books?hl=es&lr=&id=698EDgAAQBAJ&oi=fnd&pg=PR11&dq=Castillo,+A.+A.+(2017).+Curso+de+Programaci%C3%B3n+Web:+JavaScript,+Ajax+y+jQuery.+IT+Campus+Academy.&ots=Ipht2BCCy_&sig=HzfumYCdcA9uPwi3qU4z32V4cqk#v=onepage&q=Castillo%2C%20A.%20A.%20(2017).%20Curso%20de%20Programaci%C3%B3n%20Web%3A%20JavaScript%2C%20Ajax%20y%20jQuery.%20IT%20Campus%20Academy.&f=false

Cánepa Cornejo, Y. A., León Hurtado, S. S., Muñoz Zúñiga, C. J. E., & Pérez Santos, V. I. (2022). Plan de negocio para ampliar la ventana comercial para la exportación de palta Hass a Canadá para una nueva empresa. URL: https://hdl.handle.net/20.500.12640/3009

Collaguazo, K. E. J., Rosales, G. K. J., & Illesca, M. L. G. (2022, August). El Pacto Verde Europeo como premisa para la orientación estratégica de las empresas exportadoras ecuatorianas: The Green Deal as a premise for the strategic orientation of exporting companies. In *Conference Proceedings (Machala)* (Vol. 6, No. 1). URL: https://investigacion.utmachala.edu.ec/proceedings/index.php/utmach/article/view/518 DOI: https://doi.org/10.48190/cp.v6n1a4

COLLAGUAZO, L. R. Q., PULLAS, E. R. R., ALCIVAR, G. E. C., & CARATE, M. D. I. (2022). Aplicación de tecnologías. net y chart. js para el desarrollo de un tablero de indicadores clave. *Revista Científica y Tecnológica VICTEC*, *3*(4), 62-74. URL: http://server.istvicenteleon.edu.ec/victec/index.php/revista/article/view/61

Combaudon, S. (2018). *MySQL 5.7: administración y optimización*. Ediciones Eni. URL: https://books.google.es/books?hl=es&lr=&id=QpYLonKfIesC&oi=fnd&pg=PA3&dq=Combaudon,+S.+(2018).+MySQL+5.7:+administraci%C3%B3n+y+optimizaci%C3%B3n.+Ediciones+Eni.&ots=N2hrd7EmRG&sig=plXzw5nd6LzkKvjrhayHZZGDdcg#v=onepage&q=Combaudon%2C%20S.%20(2018).%20MySQL%205.7%3A%20administraci%C3%B3n%20y%20optimizaci%C3%B3n.%20Ediciones%20Eni.&f=false

Cordero-Naspud, E. I., Erazo-Álvarez, J. C., Narváez-Zurita, C. I., & Cordero-Guzmán, D. M. (2020). Soluciones corporativas de inteligencia de negocios en las pequeñas y medianas empresas. *Revista Arbitrada Interdisciplinaria Koinonía*, *5*(10), 483-514. URL: https://books.google.es/books?hl=es&lr=&id=QpYLonKfIesC&oi=fnd&pg=PA3&dq=Combaudon,+S.+(2018).+MySQL+5.7:+administraci%C3%B3n+y+optimizaci%C3%B3n.+Ediciones+Eni.&ots=N2hrd7EmRG&sig=plXzw5nd6LzkKvjrhayHZZGDdcg#v=onepage&q=Combaudon%2C%20S.%20(2018).%20MySQL%205.7%3A%20administraci%C3%B3n%20y%20optimizaci%C3%B3n.%20Ediciones%20Eni.&f=false DOI: https://doi.org/10.35381/r.k.v5i10.703

de Pablos Heredero, C., Agius, J. J. L. H., Romero, S. M. R., & Salgado, S. M. (2019). *Organización y transformación de los sistemas de información en la empresa*. esic. URL: https://books.google.es/books?hl=es&lr=&id=hnCLDwAAQBAJ&oi=fnd&pg=PT6&dq=de+Pablos+Heredero,+C.,+Agius,+J.+J.+L.+H.,+Romero,+S.+M.+R.,+%26+Salgado,+S.+M.+(2019).+Organizaci%C3%B3n+y+transformaci%C3%B3n+de+los+sistemas+de+informaci%C3%B3n+en+la+empresa.&ots=V49yOpKpFd&sig=qCuLmKuia_Zz9SYtIaKrcRcEmlM#v=onepage&q&f=false

Gironés, J. T. (2019). *El gran libro de Android*. Alpha Editorial. URL: https://books.google.es/books?hl=es&lr=&id=h_R5EAAAQBAJ&oi=fnd&pg=PR7&dq=El+gran+libro+de+Android&ots=WmcaTJRRQP&sig=yd4Ru6OlbF4Y4Ec8ul87jBGE0pM#v=onepage&q=El%20gran%20libro%20de%20Android&f=false

Lachgar, M., Benouda, H., & Elfirdoussi, S. (2018, November). Android REST APIs: Volley vs Retrofit. In *2018 International Symposium on Advanced Electrical and Communication Technologies (ISAECT)* (pp. 1-6). IEEE. URL: https://ieeexplore.ieee.org/abstract/document/8618824 DOI: 10.1109/ISAECT.2018.8618824

Logroño, D. J. B., Lara, O. O. E., & Rivera, A. D. P. (2020). Implementación del bootstrap como una metodología ágil en la Web. *Revista Arbitrada Interdisciplinaria Koinonía*, *5*(9), 268-286. URL: https://dialnet.unirioja.es/servlet/articulo?codigo=7437979 DOI: https://doi.org/10.35381/r.k.v5i9.648

Luna, F. (2019). *JavaScript-Aprende a programar en el lenguaje de la Web*. RedUsers. URL: https://books.google.es/books?hl=es&lr=&id=SqikDwAAQBAJ&oi=fnd&pg=PA4&dq=Luna,+F.+(2019).+JavaScript-Aprende+a+programar+en+el+lenguaje+de+la+Web.+RedUsers.&ots=pzbfWW1rAx&sig=bma9dGkQZx-VIIU-VkgimisX-yg#v=onepage&q=Luna%2C%20F.%20(2019).%20JavaScript-Aprende%20a%20programar%20en%20el%20lenguaje%20de%20la%20Web.%20RedUsers.&f=false

Magallan Villalon, J. J. (2022). Determinación del financiamiento y su impacto económico en pequeños productores de aguacate en el municipio de Salvador Escalante, Michoacán, México. URL: http://bibliotecavirtual.dgb.umich.mx:8083/xmlui/handle/DGB_UMICH/6714

Microsoft (2019). *La guía sencilla para la diagramación de UML y el modelado de la base de datos*. Recuperado el 10 de sepiembre de 2022 de https://www.microsoft.com/es-mx/microsoft-365/business-insights-ideas/resources/guide-to-uml-diagramming-and-database-modeling

Misericordia Eulate, I. (2019). *HERRAMIENTAS DE DISPOSICIÓN DE CONTENIDO CON NG-BOOTSTRAP* (Doctoral dissertation). URL: http://ddigital.umss.edu.bo:8080/jspui/handle/123456789/14336

Ortega, D. J. O., Asesor, O. R., & Pérez, M. A. B. (2019). Bootstrap y Laravel, herramientas para el desarrollo de aplicaciones Web. *UNIVERSIDAD POLITÉCNICA DE SINALOA, Mexico*. URL: http://repositorio.upsin.edu.mx/Fragmentos/tesinas/142016030030OvandoOrtegaDenzelJavier10843.pdf

Parada, M. (2019). Qué es jQuery. Reuperado el 11 de septiembre de 2022 de https://openWebinars.net/blog/que-es-jquery/

Pérez, J. E. (2019). introducción a JavaScript. URL: http://190.57.147.202:90/jspui/bitstream/123456789/430/1/introduccion_javascript%20%281%29.pdf

Ramos Valdez, M. E., Guajardo García, A. V., López Jasso, D. C., Puente Ortiz, D., & González Villegas, L. (2022). Estrategias para las exportaciones de empresas mexicanas en la industria alimentaria frente a la COVID-19. *The Anáhuac journal*, *22*(1), 66-97. URL: https://www.scielo.org.mx/scielo.php?pid=S2683-26902022000100066&script=sci_arttext DOI: *https://doi.org/10.36105/theanahuacjour.2022v22n1.03*

Rossi, R., & Hirama, K. (2022). Analytical Engineering for Data Stream. *Journal of Computer and Communications*, *10*(7), 13-34. URL: https://www.scirp.org/journal/paperinformation.aspx?paperid=118564 DOI: 10.4236/jcc.2022.107002

Solís Portilla, L. E. (2022). Análisis de la viabilidad de producir aguacate Hass en el cantón central de San Rafael de Heredia, durante el tercer cuatrimestre del 2021 y propuesta de una estrategia financiera. URL: https://repositorio.ulatina.ac.cr/bitstream/20.500.12411/1708/1/TFG_Ulatina_Luis_Solis_Portilla_2011011438.pdf

Sourd, F. P. (2022). XML, JSON y el intercambio de información. *Anuario Ciencia en la UNAH*, *18*(3). URL: https://rcta.unah.edu.cu/index.php/ACUNAH/article/view/1532 DOI:

Zhou, M. (2022, June). A Review of JavaScript Object Notation in Data Analysis. In *2022 8th International Conference on Humanities and Social Science Research (ICHSSR 2022)* (pp. 1771-1774). Atlantis Press. URL: https://www.atlantis-press.com/proceedings/ichssr-22/125975018 DOI: https://doi.org/10.2991/assehr.k.220504.321