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Article

Technological tools for multiplatform software development within the labor sector

Herramientas tecnológicas de desarrollo de software multiplataforma dentro del sector laboral

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Abstract

This article presents the results of a research carried out by graduates of the Software Development and Management Engineering degree, generation 2019-2022 and 2020-2023 from the Universidad Tecnológica de Tehuacán; with the objective of identifying the technological tools that the software production sector currently implements in the development of multiplatform applications. A survey was applied to the graduates according to the Tuning Latin America project to be answered based on their professional experience developed during their stay and work activity. With the statistical analysis, the programming languages, frameworks and databases implemented and/or in trend could be identified. The results were of great impact to generate a comparison with the tools implemented within the curricular map of the Educational Program and thereby strengthen its academic activities and technical knowledge to guarantee the quality of the service offered by the institution at a professional level.

Objetive	Methods	Contributios
Identify the technological tools that the software production sector currently implements in the development of multiplatform applications.	**Data Collection:** Survey. **Data Collection:** Digital survey form to emails. **Data Analysis:** Statistical analysis through an Excel software tool. **The information was processed** by creating dynamic tables.	The results obtained were used to generate a comparison with the tools implemented in the curricular map of the Educational Program of the Software Development and Management Engineering degree.

Multiplatform Software Development Tools, Labor Market, Graduate

Resumen

Este artículo presenta los resultados de una investigación llevada a cabo por egresados de la carrera de Ingeniería en Desarrollo y Gestión de Software, generación 2019-2022 y 2020-2023 de la Universidad Tecnológica de Tehuacán; con el objetivo de identificar las herramientas tecnológicas que el sector productivo de software implementa actualmente en el desarrollo de aplicaciones multiplataforma. Se aplicó a los egresados una encuesta de acuerdo al proyecto Tuning Latinoamérica para ser contestado con base en su experiencia profesional desarrollada durante su estadía y actividad laboral. Con el análisis estadístico se pudieron identificar los lenguajes de programación, Frameworks y base de datos implementadas y/o en tendencia. Los resultados fueron de gran impacto para generar un comparativo con las herramientas implementadas dentro del mapa curricular del Programa Educativo y con ello fortalecer sus actividades académicas y de conocimientos técnicos para garantizar la calidad del servicio que oferta la institución a nivel profesional.

Objetivos	Metodología	Contribución
Identificar las herramientas tecnológicas que el sector productivo de software implementa actualmente en el desarrollo de aplicaciones multiplataforma.	**Obtención de Datos:** Encuesta. **Recolección de Datos:** Formulario de la encuesta digital a los correos electrónicos. **Análisis de Datos:** Análisis estadístico a través de una herramienta de *software* Excel. **El procesamiento de la información** se llevó a cabo mediante la elaboración propia de tablas dinámicas.	Los resultados obtenidos fueron utilizados para generar un comparativo con las herramientas implementadas en el mapa curricular del Programa Educativo de la carrera de Ingeniería en Desarrollo y Gestión de Software.

Herramientas de Desarrollo de Software Multiplataforma, Mercado laboral, Egresado

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Introduction

Academic BodiesInformation Technologies (IT) through the times and the great technological advances has become an important practice within the activities and dissemination of all companies and / or industry that want to automate to streamline their processes for management, control and agility in decision making, boosting their competitiveness in the market.

The National Chamber of Industry and Electronics of Telecommunications and Information Technology (CANIETI). It is an institution of public interest, autonomous, with legal personality and its own patrimony; its main purpose is to achieve the competitive development of the National Industry with a sense of guild and social responsibility. In an article published in the year 2022, it defined that the IT industry in Mexico increasingly requires qualified human resources.

- 900,000 jobs in Mexico are related to the IT industry.
- 600,000 of them are almost IT professionals.
- 400,000 professionals are specialised in *software*.
- 65,000 new professionals specialising in the sector graduate each year.

This article is focused on identifying the cutting-edge tools that the *software* development labour market is implementing for the development of multiplatform applications from the experience of professional practices carried out by graduates of the *Software* Development and Management Engineering course at the Technological University of Tehuacán (UTTehuacán) during their stay as students and their current work activity. With the statistical analysis it will be possible to validate whether the IT Educational Programme offered by this career is implementing in its academic activities innovation methods and *software* tools to strengthen technical knowledge in line with professional needs, as well as to know the trends of new technologies to take action on it and thus avoid a lag in the quality of service offered as an educational institution of higher level.

Description of the method

According to Abero (2016) determines that quantitative research, it is proposed to argue about how in quantitative social research the reality is objective and is objectified for study. This article specifies the process, technique and instrument of quantitative research, as well as aspects referring to the processing of information and analysis of the data obtained, through the graduates of the *Software* Development and Management Engineering course at UTTehuacán, who will be the protagonists to make known under their environment and work experience, relevant information to verify whether the competencies received are in line with their professional development demanded by the sector.

The method applied to the research was inductive, as the results obtained established actions on the areas of opportunity regarding the cutting-edge methodologies and technological tools applied at an academic level for *software* development . In this way, future graduates will be able to work more efficiently in the labour sector.

Techniques and instruments

A survey was drafted with 51 questions of which 20 were open-ended, 13 were closed-ended and 18 questions were focused on professional IT competences with a *Likert* scale format with four response categories: 1 = not at all; 2 = a little; 3 = quite a lot; 4 = a lot. This scale served as a support for answering questions related to professional competences and will be carried out based on the aspects considered in the research carried out on the graduates of the Tuning Latin America project study (2011-2013), which sought to improve the quality and relevance of higher education under the focus of professional and generic competences, which served as a support to mediate it with the needs of the labour sector.

Sample design

The sample consisted of 54 graduates, who started with the Higher University Technician in Multiplatform *Software* Development and in continuity in *Software* Development and Management Engineering (generation 2019-2022 and 2020-2023) of the UTTehuacán corresponding to the 2018 study plan.

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Information collection and data sorting

The way of its application was to send a digital survey form to the e-mails with a cover letter; where a time interval was considered for its response between 10 to 15 minutes based on the provisions of the same format; a deadline of 15 days was established for its closure. Through the *GSuites* tools, the results extracted in an Excel spreadsheet could be obtained immediately for subsequent statistical analysis.

Data analysis

Data collection was done using an Excel *software* tool. This tool made it easier to establish the information and knowledge of the IT programme in order to establish the areas of opportunity and identify needs for competence training in its formative strategies. The processing of the information was carried out through the elaboration of dynamic tables. A data analysis was constructed with 37 variables, working with frequency tables and relating variables by categories. In addition, bivariate tables were drawn up, from which the data analysis was carried out and the objective was verified.

Results

With the results obtained, we can identify which *software* development technologies are currently required by the market based on technological advances. With these *software* tools, companies are demanding the creation of applications compatible with various platforms. This allows the expansion of their products and services at an international level by promoting themselves through an innovative technology that is accessible, compatible and functional in different devices that are available to everyone.

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- Academic Bodies in Consolidation
- Academic Bodies in Formation
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- Programme for the Improvement of Teaching Staff
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- United Nations Educational, Scientific and Cultural Organisation
- Polytechnic Universities
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- Polytechnic University of Tulancingo
- Polytechnic Universities of the State of Hidalgo
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Box 1

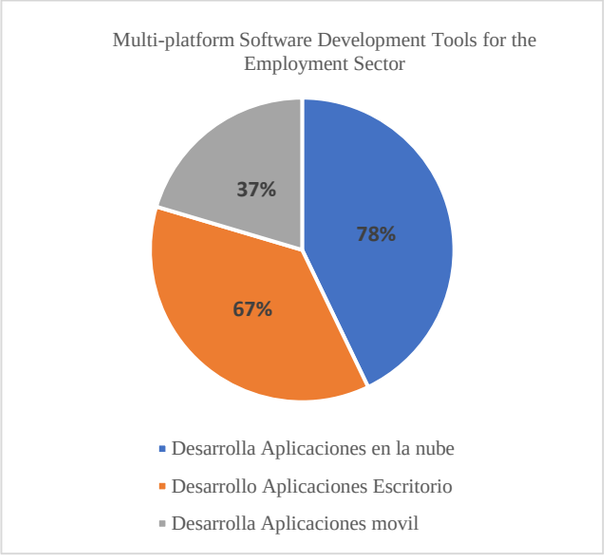

Figure 1
Multi-platform Software Development Tools

Source: Own elaboration

The above graph identifies the percentages in the development of cloud applications, which is the most significant activity with 78%, followed by the development of client/server applications with 67%; 37% of companies develop for mobile applications.

This result happens because cloud applications currently have the advantage of being able to connect to a remote server to have immediate information for decision making at any time with internet connection or a local network; Based on technological trends cloud applications allow companies to have better communication to offer product or services to a more global customer, also streamlines operational processes, improve their marketing.

It was also possible to determine the three main categories to be identified:

- Client/server applications.
- Cloud applications.
- Mobile applications.

Each category was analysed according to: Programming languages, Frameworks / Libraries and Database most used within the employment sector.

Client/server applications

Box 2

Table 1
Programming language for Client/Server applications

Programming Languages	Frequency	Percentage
Java	26	49%
PHP	12	23%
C#	7	13%
JavaScript	5	9%
C++	1	2%
Visual Basic	1	2%
Open to developers	1	2%
Total general	**53**	100%

Source: Own elaboration

Of the three programming languages for the development of client/server applications. Of the three programming languages for client/server application development, 49% use Java, followed by PHP (23%) for Web environments and C# (13%). It can be determined that although this technology uses an internal network connection to be able to work. It is important to emphasise that currently many companies or institutions from different sectors prefer to keep their information on local equipment because their services are based on certain needs that do not require communication with the outside world at a global level..

Box 3

Table 2
Framework / Library for client/server applications

Frameworks/ Bookshops	Frecuency	Porcentage
Spring Framework	14	35%
Laravel	5	13%
React	4	10%
Netbeans	4	10%
ASP .NET	4	10%
Angular	2	5%
Boostrap	2	5%
Vue.js	2	5%
Entity Framework 4.5.1	1	3%
Symphony	1	3%
Open to developers	1	3%
Grand total	**40**	**100%**

Source: Own elaboration

Table 2 analyses the Frameworks or libraries that are being implemented to support programming languages. Firstly, the Spring Framework is implemented to develop Java applications, occupying 35%. Also Laravel is with 13% and React, Netbeans and ASP.Net are with 10%.

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Frameworks are used by programmers because they allow them to speed up their work and encourage collaboration, reduce errors and obtain a higher quality result. UNITE FP (2022). Their frameworks speed up and facilitate the creation of applications in less time and cost.

Box 4

Table 3

Database for desktop applications.

Database	Frecuency	Porcentage
MySQL	13	30%
SQL Server	7	16%
Amazon RDS	2	5%
PhpMyAdmin	2	5%
PL-SQL	2	5%
MariaDB	1	2%
Oracle	1	2%
Xampp	1	2%
Unknown	15	34%
Grand total	**44**	**100%**

Source: Own elaboration

It can be defined that the databases that are used for the development of desktop applications are MySQL with 30%, SQL Server with 16% and there is a tendency of equal value of 5% which are Amazon RDS, PhpMyAdmin and PL-SQL.

The MySQL database is easy to use and provides tools to work with any type of application and there are several providers that offer it free of charge, which means that these versions are limited for some needs. Microsoft SQL Server is preferred in enterprise environments because of its integration with Microsoft products, greater scalability and better security; these benefits come at a cost. Both platforms are popular for their stability, performance and support for large user communities.

Cloud applications

In Table 4. It can be identified that the programming language used by the labour sector where graduates carry out projects for cloud development is TypeScript with 26%; JavaScript 22%; PHP with 19% and Java with 11%.

Box 5

Table 4

Programming language for cloud applications

Programming Languages	Frequency	Percentage
Typescript	23	26%
JavaScript	19	22%
PHP	17	19%
Java	11	13%
C#	8	9%
Kotlin	3	3%
Python	3	3%
PL-SQL	2	2%
Azure DevOps	1	1%
Database development only	1	1%
Grand total	**88**	**100%**

Source: Own elaboration

According to The Qt Company (2023). A library is a set of tools and resources that allow developers to create applications that work across operating systems and platforms. These libraries provide an abstraction layer that hides the differences between the underlying systems, which facilitates the development of cross-platform applications.

Box 6

Table 5

Framework/Library for cloud applications.

Frameworks/ Bookshops	Frecuency	Porcentage
JQuery	28	29%
Express.js	15	16%
React.js	11	11%
.Net Core	8	8%
Laravel	8	8%
Vue.js	8	8%
Angular	7	7%
Spring	5	5%
App Engine	1	1%
ASP .Net	1	1%
Azure DevOps	1	1%
Boostrap	1	1%
Symphony	1	1%
Grand total	**95**	**100%**

Source: Own elaboration

Among the most mentioned libraries were JQuery with 29%; Express.js with 16%; React.js with 11% and with 8% .Net Core, Laravel and Vue.js. Mentioning that the last three represent *Frameworks.*

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Box 7

Table 6
Database for cloud applications

Database	Frecuency	Porcentage
Mysql	12	27%
PL-SQL	3	7%
AZURE SQL	2	4%
Google cloud	1	2%
phpMyadmin	1	2%
Unknown	26	58%
Grand total	**45**	**100%**

Source: Own elaboration

The database managers that most distinguished themselves in the development of cloud applications are similar to those of client-server development because they are efficient based on the needs of the projects. Azure belongs to the Microsoft family. MySQL with 27% followed by PL-SQL with 7% and Azure SQL with 4%. In the same way it is denoted that most of the graduates are only in charge of FrontEnd development due to the fact that 58% answered that they did not know the manager that is implemented.

Mobile applications

Box 7

Table 8
Programming languages for mobile applications.

Programming Languages	Frecuency	Porcentage
Java	12	36%
TypeScript	9	27%
PHP	5	15%
C#	3	9%
Dart	2	6%
Flutter	1	3%
JavaScript	1	3%
Grand total	**33**	**38%**

Source: Own elaboration

Of the 38% of respondents who answered yes, the company developed mobile applications. The programming language for these devices is based 36% on Java and 27% on TypeScript and 15% on PHP.

Currently, development in this technology is growing considerably because it has become an indispensable tool for all sectors, offering a number of advantages that improve efficiency and connectivity in the work environment. The mobility provided by mobile devices allows access to crucial information from anywhere, which is essential in a dynamic and globalised business world. In short, the mobile phone has become an essential technological tool that enhances efficiency and communication in the business environment.

Box 9

Table 8
Framework/Library for mobile applications

Frameworks/ Bookshops	Frecuency	Porcentage
Java	12	34%
React Native	6	17%
XML	6	17%
Vue.js	3	9%
Ionic	3	9%
Kotlin	2	6%
Flutter	1	3%
Xamarin	1	3%
Unknown	1	3%
Grand total	**35**	**100%**

Source: Own elaboration

Java is being implemented for Android operating systems with 34%; React Native and XML with 17%; Vue.js and Ionic are at 9% usage within the workplace. Although it should be noted that much will depend on the impact of the applications to determine which would be the most suitable.

It can be seen that Java is one of the most widely used programming languages for mobile application development, as it allows the creation of applications that can run on a variety of devices, which facilitates compatibility in the mobile device market. In addition, it is a language that offers portability, performance and a large support community.

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Box 10

Table 9
Database for mobile applications

Database	Frecuency	Porcentage
MySQL	8	35%
Microsoft Azure SQL Server	6	26%
Oracle	3	13%
Firebase	1	4%
Microsoft SQL Server	1	4%
SQLite	1	4%
Unknown	3	13%
Grand total	**23**	**100%**

Source: Own elaboration

MySQL remains the mobile application manager with 35%, followed by Microsoft Azure SQL with 26% and Oracle with 13%.

The results were made known in meetings with teachers of specialised subjects in order to take internal actions to maintain and strengthen the professional needs that are required in the professional sector.

The observations generated by the educational programme were summarised and classified into the following points of interest:

1. The objective of the course is being fulfilled due to the fact that the majority of the graduates are active in their professional activity.

2. The technical competences are in line with the needs of the sector due to the fact that the IT programme, through its teachers, holds meetings.

3. With the analysis of results either from the Interest meetings or the ASTs and now with this research, agreements are established to homologate languages, *Frameworks*, libraries or databases in tendency to the new demands and needs.

Conclusions and Recommendations

This research managed to identify the implemented tools of multiplatform *software* development within the labour sector of *software* development because it allowed to have a very wide frame of reference in comparison with other internal activities due to the fact that the graduates could give a wider and more objective vision about the tools implemented in their companies.

The results serve as a complement to other results established within the operational activities and determine the new aspects to be considered and to continue fulfilling the objective of the IT Educational Programme at UTTehuacán.

Similarly, this research will serve other educational institutions so that they can learn about the *software* development technologies of existing projects in the labour market and compare the relevance and impact of the strategies on the *software* tools implemented in an academic way. On the other hand, the results strengthen the confidence of the productive sector of the region of the Municipality Tehuacan, of the State of Puebla, National or International since the good performance of the professional activities of the graduates will have a considerable impact on their projects.

Declarations

Conflict of interest

The authors declare that they have no conflict of interest. They have no competing financial interests or personal relationships that could have influenced the content of this article.

Authors' contribution

Curioca-Varela, Yedid: I contributed the project idea to the development of the research.

Galicia-García, Christian: I contributed with the methodology and data analysis.

Alfaro-Herrera, Julio Cesar: I contribute to the implementation of data collection.

Ortega-Gines, Héctor Bernardo: I contribute to the analysis of results and the implementation of academic actions.

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Availability of data and materials

The data used and the results matrix for the analysis are available on request.

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Abbreviations

CANIETI

The National Chamber of the Telecommunications and Information Technology Industry and Electronics.

UT

Tehuacán Technological University of Tehuacán.

IT

Information Technology

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Background

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