

Digital maturity model for continuous improvement

Modelo de madurez digital para mejora continúa

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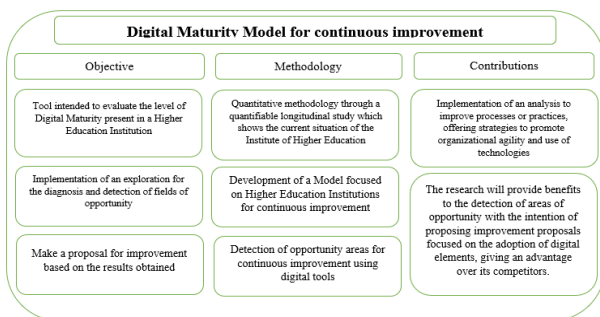


Abstract

The present research work presents the development and implementation of a Digital Maturation Model (MMD) designed and adapted to the Institute of Higher Education, Establishing the degree of Digital Maturity present in the Institute of Higher Education located in Orizaba, through the development and application of a Digital Maturity Model. Outlining strategic planning oriented to the analysis necessary to generate improvement proposals through the use of digital technologies, increasing efficiency and competitiveness, improving the service offered. The present research will take a quantitative methodology through a longitudinal study with the intention of obtaining a before and after, through a quantifiable approach, obtaining the evaluation of the Digital Maturity Index and the detection of areas of opportunity for the proposal of improvements.

Resumen

El presente trabajo de investigación presenta el desarrollo e implementación de un Modelo de Maduración Digital (MMD) diseñado y adaptado al Instituto de Educación Superior, Establecer el grado de Madurez Digital presente en el Instituto de Educación Superior ubicado en Orizaba, mediante el desarrollo y aplicación de un Modelo de Madurez Digital. Trazando una planificación estratégica orientada al análisis necesario para generar propuestas de mejora mediante el uso de tecnologías digitales aumentando eficiencia y competitividad mejorando el servicio ofertado. La presente investigación tomara una metodología cuantitativa mediante un estudio longitudinal con la intención de obtener un antes y un después, a través de un enfoque cuantificable, obteniendo la evaluación del Índice de Madurez Digital y la detección de áreas de oportunidad para la propuesta de mejoras.



Digital Transformation, Digital Maturation Model, Higher Education

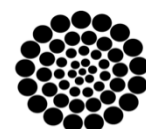
Transformación Digital, Modelo de Maduración Digital, Educación Superior

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Introduction

Currently society demands new changes, based on the adoption of digital transformation, implying an era of digitalisation in different sectors of humanity (Mergel et al., 2019; Voss et al., 2022) described that digitalisation is the result of the incorporation of digital technology and how its influence within organisations can detonate benefits.

Digital transformation has the capacity to improve the strategic position of organisations (Teixeira et al., 2021; Castro, et al., 2022). It contributes to the social, cultural and industrial spheres by driving trends and teaching new digital skills. Therefore, it is an organisational evolution that takes into account different perspectives seeking a holistic and evolutionary integration. It involves gradual change resulting in deliberate and conscious actions aimed at introducing change characterised by a fusion of technologies that blurs the boundaries between physical, biological and digital.

It triggers the obligation for organisations to assess their digital maturity by determining viable strategies for metamorphosis and continuous improvement (Ka et al., (2023).

Therefore, it is understood that digital transformation has the capacity to empower organisations, emphasising the need for research to develop a Digital Maturity Model (DMM) to analyse the level of digitalisation (Voss et al., 2022) explained that different DMMs exist for a wide variety of sectors or application domains.

Arguing that digital maturity is not just a characteristic that every company must fulfil, (Rafael et al., 2020). In the research of (De Carolis et al., 2017) they highlighted the importance of assessing a Digital Maturity Index that allows a process and dimension-oriented measurement.

Therefore, dynamic capabilities can be linked to the primary objective of TD which is also based on the business perspective defined as an ability to reconfigure a company's resources and routines in a way that can be considered appropriate by its key decision-makers. This implies that regardless of the type of organisation it is essential to have an open mind focused on change as this can generate positive benefits, opening doors for increased competitiveness.

Background

It is important to recognise that COVID-19 sparked a digital transformation exploding the interest of academics and practitioners, accelerating the adoption of Industry 4.0 principles within global economies as expressed by Kargas, et al., (2023) implying a metamorphosis in the social, industrial, economic and educational spheres.

This event created what Crawford, et al., (2020) called the COVID-19 response, implying that HEIs will present an accelerated digital and technological transformation as they respond to the pandemic by moving from a face-to-face model to a fully online one, highlighting the existence of institutions that are better prepared than others. This implied the need to update educational and administrative processes with the intention of adapting to the confined environment, creating a global trend towards the use of digital resources.

A digital culture is born, directly associated to Higher Education Institutions, increasing competitiveness, process improvement, viability and growth (Tubis, 2023). The interest in Digital Maturity generates initiatives to increase performance in a digitised environment, therefore, in the coming years, resources must be invested and practices that understand the potential of emerging technologies must be implemented (Durek et al., 2018).

Taking into account the results of the research conducted by (Fernández et al., 2023) where 39 Spanish universities were analysed, an area of opportunity for continuous improvement was identified.

Pointing out that 75% of the universities analysed do not have a digital strategy while 56% achieved isolated initiatives aimed at digital transformation, it was also detected that only 6% achieved their strategic objectives. (Fernández et al., 2023). Highlighting the need to delve deeper into this topic, highlighting the relevance for HEIs to adopt digital transformation as a necessity for the future, for organisations that seek to be leaders in their field.

It is therefore necessary that the present work aims to bring this trend closer to Higher Education Institutions, analysing and restructuring their decision making, changing their organisational culture, as well as the mechanisms for the development of strategies. Emphasising that Digital Maturity is systemic and cross-functional, it comes to the fore to assess the level of digitalisation of a given organisation, industry or national economy as it is considered a distinguishing feature of highly successful organisations around the world (Ershova & Enkova, 2023).

Theoretical framework

Digital Transformation

By implementing digital technologies embedded within the everyday life of society the concept of Digital Transformation (DT) is born which emerges as the need to innovate in digital competences by using creativity with the aim to improve and support traditional methods as mentioned by changing the paradigm drastically. Demonstrating that digital transformation represents a profound change in business activities for organisations by modifying processes, competences and models, blending technology with society impacting on strategies, along with the way these can support improvements (Castro, et al., 2022). Incorporating digital technologies that require a certain amount of time for their implementation, carrying out planning that will guide companies, organisations or institutions in the digital transformation. Implying that within the current and future processes an evolution is necessary for decision making.

Considering that digital transformation represents the reconstruction of technological bases oriented to new areas of opportunity, converting business models, processes, products or services through innovation (Salas, et al., 2020). Resonating that TD seen from a business perspective represents the need for a metamorphosis oriented to user experiences and operations incorporating digital tools. Emphasising the importance or necessity of its implementation becoming a priority to be developed in both the Industrial and Educational spheres.

Therefore, digital transformation is an intrinsic and characteristic feature for products and services, implying that it will cease to be a goal to become a basic particularity for any organisation or Higher Education Institute as expressed by Álvarez et al. Pointing out that TD will lose its importance as a differentiator by becoming a necessary characteristic for any organisation.

This leads Higher Education Institutions to highlight the importance of digital services and their implementation (Sych et al., 2021) through the adoption of technologies such as artificial intelligence, Big Data or information systems focused on management, establishing a need to modernise processes by implementing digital devices covering administrative or learning processes.

What is Digital Maturity?

Digital maturity was born during the massification of emerging technologies, specifying that it is the present state or level of digital transformation of a company, using it to describe the degree of adoption of technological tools of an organisation. Meaning that it should be a fluid process with the objective of technologically reshaping business or cultural models.

Through continuous digital transformation, providing direction in conjunction with criteria that measure the status and performance of an organisation or institution of any kind. This implies the aim of positioning oneself at an advantageous point as expressed by (Matt et al., 2015). Through the digitisation of processes, remembering that such maturity will vary depending on the unique characteristics of each entity.

Implying the need to assess the readiness of an organisation based on facets such as strategy, organisation, technological infrastructure and capabilities, where the intensity of digital transformation refers to the degree of digitisation of operations and organisational management by measuring the strengths of the implementation, allowing to determine essential characteristics.

Digital Maturity Model (DMM)

During the last two decades, several studies covering maturity models have been carried out, where a methodology for the main stages of maturity model development was found, and an increase in the popularity of DMMs in organisations has been visualised, formulating different proposals due to the various sectors in which they can be applied.

Affirming that the amount of present models oriented in Maturity is wide, although when focusing it to the digitalisation, it was appreciated that generic models exist, that share similarities between them, in spite of having different applications, this generates the necessity to investigate and to identify models that really are of benefit for the investigation, for this reason it is shown inside the Table 1 MMD used inside different areas, emphasizing its orientation to the digitalisation of the processes..

Box**Table 1**

Digital Maturity Models

Year	Autor	Aim of the study	Implementation intentions
2017	Carolis et al.	Propose a framework for investigating the digital maturity of companies.	Methodology oriented to manufacturing companies and research development for the determination of their digital readiness level. Developing a scoring method.
2017	Danjou et al.	Introduce a business model to highlight digitisation and connectivity areas in companies.	Creating a framework for determining maturity levels within digital enterprises. Implementing a review to detect areas of opportunity..
2017	Grange and Ricoul	Defining maturity stages for digital businesses.	Proposal of a maturity model aimed at providing a research framework for companies in the digital area. Using a systematic review.
2017	Bostrom and Celik	Determining digital business drivers and developing a maturity model	Providing a conceptual framework capable of showcasing researchers' findings on digital business strategies. By conducting a review.
2017	Hagg and	Research articles on	A guide for

	Sandhu	digital transformation a framework for digital maturity	managers with the intention of visualising in an orderly fashion the implicit improvements within the digital maturity levels. Applying an abductive approach and thematic analysis
2017	Tavakoli and Mohammadi	Define the digital business of companies and their digital maturity and analyse the positive effects of digitalisation on these companies.	Determine for retail companies their level of digital maturity for the distribution process. Through qualitative interviews, questionnaire and theoretical research..
2017	Wibowo and Taufik	Provide a self-assessment tool for companies to measure their level of maturity.	Implementation of digital maturity self-assessment as a tool for building projects in Indonesia. Implementing the Delphi method and AHP method..
2018	Gastaldi et al.	Develop a model to measure the level of digital maturity in the health organisation.	Application of the 2 phases of the ISMETT hospital model. Applying a Benchmarking study.
2018	Mettler and Roberto	Analysing the effects of digital maturity and factors in hospitals	Application of the status quo in Swiss hospitals. Through the implementation of an exploratory descriptive analysis.
2018	Colli et al.	Assessing the digital maturity of companies through 360° assessment	Application of an MMD in Danish manufacturing companies. Through a problem-based learning model..
2019	Khanbhai et al.	Assessing the real-time utilisation of feedback systems and their digital maturity	Provide a patient acceptability review for digital maturation technology. Through a review

Soure (Buyukozka & Guler, 2020).

Table 1 shows the maturity models that were found in the literature review conducted by (Buyukozka & Guler, 2020). Highlighting how different authors were given the task of creating different models for various sectors where their application is viable thanks to the great flexibility of these tools and how their popularity has increased since 2017, highlighting their flexibility and ease with which the models can be adapted.

Therefore, Digital Maturity Models are widely used tools within organisations with the objective of assessing their digital capabilities, identifying areas of opportunity for continuous improvement. Highlighting that the DMMs have the ability to provide a roadmap that supports different purposes seeking to understand their strengths and weaknesses about their digital maturity, allowing the development of strategic initiatives that facilitate the process of technology adoption that grants higher levels.

Remembering that the purpose of these tools is to evaluate dimensions, highlighting that the number of dimensions may vary depending on the type of organisation, gathering information through the use of interviews and surveys, with specific indicators whose purpose is to obtain a diagnosis of the organisation, measuring the degree of adoption of digital transformation present in internal and external processes.

Digital Maturity Index

For the correct evaluation of the IMD it is necessary to take into account dimensions such as: leadership or digital vision, which is responsible for driving the transformation and digital capacity that helps to achieve technological innovation aimed at improving the operational management and competitiveness of organisations (Merdin et al., 2023), obtaining new capabilities that are developed with the organisation's resources.

This means that the development of these capabilities must be meaningful and occur in an integrated way along with the dimensions of the organisation highlighting strategy, human capital, culture, structure, management systems, business processes and technology. Recalling that TD is a process conceived from strategic planning, becoming a multidimensional process. Implying that the evaluation of the Digital Maturity Index is the means by which the level of digital transformation or degree of maturity in the HEI will be known, achieved through a series of indicators, allowing an individual and global vision. Without forgetting that there is a perspective to understand the organisations, allowing to obtain a complete picture, remembering that the TD is given in an integral way.

Without forgetting that, although organisations may share the need to transform digitally, the resources and capabilities of each company are different, which creates a disparity because each of them must adapt the Digital Maturity Index to their own needs and characteristics, in order to ensure an analysis that is able to truly show the situation of each one.

Impact of Digitalisation and Digital Maturity in Higher Education

Currently, the educational technologies used from the second decade of the 21st century seek to support both the teaching processes and the external and internal processes of Higher Education Institutions by implementing digital tools and developing modern competences that involve the implementation of technologies, corresponding to the global trend of digital development and its consequent modification of the educational system, undergoing radical changes (Sych et al., 2021). This presents digital transformation as an element that seeks to fundamentally change entire industries or organisations, recognising the need to focus on the technological as well as the social domain to achieve a successful transformation considering that digital transformation in Higher Education Institutions is a renewal perspective for their business model aligned with technological trends.

Therefore it is understood that there is a field of opportunity for the development of digital transformation within Higher Education Institutions, generating a need to develop Digital Maturity Models, oriented to a determination that allows positioning the level of maturity of the Higher Education Institute, triggering a continuous improvement oriented to the adoption of digital technologies for the improvement of the detected fields of opportunity, adding the institute to a global trend, seeking to have a fundamental characteristic for the future by adopting this characteristic as a fundamental competence for success.

General objective

Establish the degree of Digital Maturity present in the Institute of Higher Education located in Orizaba, through the development and application of a Digital Maturity Model. Drawing a strategic planning oriented to the necessary analysis to generate proposals for improvement using digital technologies increasing efficiency and competitiveness by improving the service offered.

Specific objectives

- To analyse and delimit the necessary capabilities for Digital Maturity.
- Establish and develop the Digital Maturity Model focused on the Higher Education Institution.
- Determine the current state of Digital Maturity present in the HEI.
- To put forward a proposal for improvement based on the results obtained.

Goals

The main goal of the research is to evaluate the Digital Maturity Index of a Higher Education Institution by defining organisational dimensions that promote digital transformation, determining the level of each one of them, knowing the current state of Digital Maturity. Considering that digital transformation should be part of the basis for new opportunities for organisational evolution through innovation.

By conducting an applied research, which revolves around the creation of a Digital Maturity Model oriented to a Higher Education Institution, which seeks to analyse the entire organisation. Creating dimensions that cover all the crucial areas of the organisation, collecting quantitative information and analysing it qualitatively, providing the opportunity to generate a continuous improvement programme, through the generation of proposals for improvement, for the areas of opportunity detected.

Implying that circumstances are generated that propitiate a high competitiveness on the part of the organisation, remembering that the Technological Transformation is a necessity that society itself demands. The integration of new technologies in daily life is part of everyday life. Likewise, it is the duty of ITES to adopt new trends.

Impact

A Digital Maturity Model generates an indicator called Inicie, which is made up of indicators for organisations in defined dimensions, generating a weighting that allows each of them to be evaluated, obtaining a comparable value oriented towards objectives which are: creating a culture based on quantifiable data, measuring digital transformation, evaluating key indicators, identifying strong points and areas for improvement, identifying best practices and valuing the work of the entities that make up the organisation.

Therefore, with the advent of digital transformation came the implementation of allied instruments that act in a decisive way with the aim of adapting to the demands of a permanently competitive market. This brings about challenges for organisations, implying a change in existing business models, originated by the technological adoption of emerging tools, integrating a new organisational culture supported by a strategy enhanced by the digitalisation of processes.

Demonstrating that digital transformation within the education sector can achieve and promote opportunities for the development of strategies that provide institutions with digital inclusion, avoiding being outdated, favouring the increase of productivity, competitiveness, quality and increasing the attraction of new customers by improving the educational offer.

Methodology

This research will take a quantitative methodology through a longitudinal study with the intention of obtaining a before and after, through a quantifiable approach which shows the current situation of the Institute of Higher Education through quantifiable data, measuring the effect of TD showing how it affects the organisation following an order:

- I. Definition of the sample by focusing on a single HEI.
- II. Development of a Digital Maturation Model designed specifically for the research.
- III. Systematic review of research or projects focused on digital transformation.
- IV. Data collection through interviews and questionnaire surveys.

Article

- V. Analysing data descriptively, quantitatively through regression and correlation analysis.
- VI. Processing of data obtained by assigning an identifier, generating a database.
- VII. Identification of areas for improvement and analysis of results.

This research contributes by implementing an analysis focused on the improvement of processes or practices, offering strategies to boost organisational agility and the use of technologies, thanks to the information gathered from successful cases, identifying opportunities for improvement.

The findings will guide decision making in order to improve skills, leading to better organisational outcomes and increased competitiveness within a dynamic environment by cross-checking data and analysing study results to increase the validity of the findings.

Maintaining the confidentiality and privacy of participating individuals within the data collection by focusing on sensitive data, maintaining confidentiality in internal processes, digital or financial strategies, maintaining impartiality with the intention of maintaining consent, highlighting the voluntary approach to data collection, analysing and presenting truthful results, subject to examination or approval in order to avoid any possible conflict of interest.

Conclusion

In conclusion, it is accurate to note that dynamic capabilities and digital transformation together represent the ability of a company to integrate, build and reconfigure its internal and external competencies in order to cope with changing environments [Li, & Liu \(2012\)](#). Understanding this definition helps to understand how digital transformation plays an important role in the competitiveness of organisations.

Creating a field of opportunity for Higher Education Institutions or companies in order to improve and rebuild their competences, adapting to current trends and demands, without losing sight of the need to maintain a competitiveness that allows them to position themselves at an advantage compared to their competitors, managing to measure and quantify these improvements.

The research will provide as benefits the detection of areas of opportunity with the intention of proposing improvement proposals focused on the adoption of digital elements with the ability to give an advantage over their competitors.

Authors' contribution

Fernandez Perez, Vladimir Damian In charge of conducting the investigation

Fernandez Gómez, Tomas In charge of literature search

Ramirez Rodriguez, Ramón Rodolfo In charge of defining the methodology to be used

Fernandez Perez, Mitzy E. Data analysis and writing manager

Availability of data and materials

The articles used within the table and important points to support the information of this project are available.

The data used are those found through a literature search.

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Abbreviations

- 1.- HEIs - Higher Education Institute
- 2.- DMI - Digital Maturity Index
- 3.-DMM - Digital Maturity Model
- 4.- DT - Digital Transformation

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Background

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