Digital Transformation Model for Universities: A Preliminary Proposal

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Abstract

This article presents a preliminary theoretical model of digital transformation for the Universidad Autónoma de Chile. The research corresponds to a case study with a mixed-methods approach (quantitative and qualitative), analyzing the dimensions and factors of the model based on input from 97 students and eight experts. The resulting model consists of three phases (availability of digital resources, use of digital resources, and integration of digital technologies), nine dimensions (strategy and culture, financial resources, technological infrastructure, student-centered focus, teaching-learning processes, economic and administrative processes, IT governance, capabilities and skills, and internal process management); it also identifies 54 indicators that highlight the relationship between digital maturity and value generation for students. The study identifies key success factors in the university's digital transformation, including student-centeredness, lifelong learning, commitment to the transformation process, and effective coordination and management of processes. The article concludes by outlining the factors that determine the institution's ability to implement strategic,

technical, and logistical technological changes. It also suggests further studies to redefine the roles of students, faculty, and administrative staff, increase digital maturity, continuously innovate services and processes, and create student-centered digital learning environments.

Keywords: digital transformation, digital maturity, educational technology, higher education, information technology.

1. Introduction

The main objective of this study is to construct a digital transformation model specific to the Universidad Autónoma de Chile, based on the essential dimensions and factors identified by students and subject matter experts. This article answers the question: What is the theoretical model of digital transformation that the Universidad Autónoma de Chile can implement?

To avoid possible misunderstandings, it is important to clarify that the digital transformation model describes a change process that uses technology as the foundation for its design and implementation. Therefore, in this article, the expressions "digital transformation model" and "digital transformation process" are used interchangeably for the purpose of disseminating the results of this research.

The value of information technologies in a knowledge economy has been analyzed from the perspective of profitability—from the moment a technological infrastructure is implemented in an organization to the point at which digital transformation is achieved through the alignment of strategy, structure, and technology to face the challenges of the digital environment. This evolution requires adopting a strategic approach focused on innovation—not only in products and services, but also in the interactions between users and technology. This affects finances, value creation processes, the use of technological resources, and the organizational structure.

In the field of higher education, there is still no clear data on the success rate of digital transformation projects (Catlin et al., 2015). This process has not kept pace with societal change and has often not been driven by a university-wide strategy, but rather by

discretionary decisions made by faculty, many of whom have lacked institutional support (Rodríguez-Abitia & Bribiesca-Correa, 2021). The challenges include generational differences between students and teachers, inadequate leadership, a resistant organizational culture, poor planning, and a lack of financial resources (Balyer & Öz, 2018; Rodríguez-Abitia & Bribiesca-Correa, 2021).

In this context, although the development of specific digital capacities leads to greater digital maturity and there are models for assessing effectiveness in companies (Castro et al., 2022), there is still no framework for measuring digital maturity in academia (Rossmann, 2019). This lack of research makes it difficult to implement digital transformation projects in higher education institutions, which need to address critical areas such as online teaching, the science and innovation system, knowledge digitalization, and university management. Even though digital transformation in the university context is not new, there is still no uniform understanding of its implications or how to manage it (Kopp et al., 2019).

Consequently, considering that the success of any disruptive change model in higher education depends on understanding each university's cultural and financial particularities, this research becomes especially relevant. The digital transformation model presented here is embedded in a framework that facilitates the development of key capabilities leading to success in the digital era.

2. Theoretical Framework

From a conceptual perspective, digital transformation has been defined from various approaches. For example, it has been understood as a change process—disruptive or incremental—that begins with the use of digital technologies and subsequently evolves toward the holistic digital transformation of the organization (Teichert, 2019), and as "a process that aims to improve an entity by causing significant changes in its properties through combinations of information, computing, communication, and connectivity technologies" (Vial, 2019, p. 119). It has also been defined as a process of organizational transformation (Brdesee, 2021) that facilitates the development of new models and competencies, strategically supported by digital technologies and

information about student success factors, resource allocation, and the effectiveness of educational and institutional programs (Marks et al., 2016).

Another perspective assumes that digital transformation is "the profound and accelerated transformation of activities, processes, competencies, and business models to fully leverage the changes and opportunities offered by digital technologies [...] in a strategic and prioritized manner" (Demirkan et al., 2016, p. 14), while other authors conceive digital transformation not as a process of transformation, but as a management process that guides the culture, strategy, methodologies, and capabilities of an organization based on the use of digital technologies (Crespo & Pariente, 2018).

The complexity of the elements involved in digital transformation has been emphasized by Rossman (2019), who points out the need to develop a set of capabilities linked to leadership, the market, operations, people and skills, culture, governance, and technology. Other authors relate digital transformation to four categories of factors: organizational values (culture), management capacity, organizational infrastructure, and workforce capabilities (Muehlburger et al., 2019).

According to Brdesee (2021), digital transformation is based on five fundamental pillars: (1) a digital business strategy; (2) organizational engagement with customers and users; (3) the presence of an innovation culture; (4) technology; and (5) data analytics. This reveals that digital transformation goes beyond technological boundaries to become a strategic component of the value creation system. Regardless of the approach used, there is a certain degree of agreement in the literature that the digital transformation process transcends the purely technological and expands into the organization.

In the specific context of higher education institutions, digital transformation implies an accelerated renewal of processes, skills, and models to maximize the opportunities provided by digital technologies (Demirkan et al., 2016). It is also defined as a management process that guides the culture, strategy, methodologies, and capabilities of an organization through the use of digital technologies (Crespo & Pariente, 2018), and as a change—either disruptive or incremental—that begins with the use of digital technologies and evolves toward a holistic transformation of the organization (Teichert, 2019).

This new, globally interconnected scenario highlights the importance of ideas, innovation, and relationships (Kelly, 1997). Yet, although digital transformation has been a global priority for the past two decades (Xu et al., 2018), many organizations still struggle to change their routines, processes, structures, and culture—an issue that has broad implications for strategic management, governance, knowledge management, and innovation (Almatrodi & Skoumpopoulou, 2023).

This transformation requires profound cultural changes and new models of management, teaching, and innovation in organizational, technological, and sociocultural dimensions (Castro et al., 2022; Ramírez-Montoya, 2020). Therefore, knowledge management is an essential component for the digital transformation of universities and should not depend on temporary crises or the mere acquisition of technologies, as happened during the COVID-19 pandemic.

The dynamic and evolving nature of digital transformation implies understanding the concept of maturity as an integrated framework for measuring the development of key capabilities that lead to success in the digital era (Lorenzo, 2016). This maturation process requires progressive changes and incremental improvements to maximize the value of technology within organizations. Digital transformation demands an interdisciplinary and multidimensional model that defines how the organization interacts with its ecosystem to create value (Lorenzo, 2016). However, recent theoretical developments in digital transformation practices are generic and do not provide a specific framework for universities.

The construction of the model was based on the premise that it is possible to achieve a certain maturity of a university's strategic processes if the level of digitalization of each of the proposed dimensions in the construct reaches its highest level. The dimensions that form the preliminary structure of the digital transformation model for universities are shown in Table 1.

Table 1: Preliminary Structure of the Digital Transformation Model for Universities.

Theoretical Support	Dimension	Description
Catlin et al. (2015)	Key capabilities and resources	It involves digitizing the aspects that generate value within the organization and are sources of competitive advantage.
	IT investment	Adequate technical support, digitization of physical machines, virtualization, and the transfer of analog to digital.
Crespo y Pariente (2018)	Institutional strategic framework focused on digital transformation	A comprehensive strategy focused on the service provided by the university and driven by digital technology, which involves all processes that generate value in the long, medium, and short term.
Valdez de León (2016)	Student life cycle	New benefits created in the student experience thanks to digital transformation. This encompasses the student's journey through the university, promotion, recruitment campaigns, registration, teaching, job search, and alumni follow-up.
	Ecosystem	Focused on the stakeholder experience. It refers to the development of a strategic network of partners as a key element for a comprehensive solution for the student.
	Processes	Transforming teaching for digital education. Transforming the dynamics of teaching and learning.
Gobble (2018)	Organization and structure	How functions are organized within the University, roles and responsibilities, talent and learning, governance, IT leadership, and how work is designed and adapted through ICT.
Furedi (2011)	Points of contact with the student	Students need support anytime, anywhere, and on any device. Service points must be digitalized.
Salinas y Vio (2011)	Flexible and personalized teaching	From one-size-fits-all to tailored learning. Managing individualized student information through predictive data analytics to deliver personalized advising systems.

Theoretical Support	Dimension	Description
Sánchez y Fernández (2010)	Social Networks and Profile Research.	It involves educational marketing, recruiting new students, analyzing click-through rates to assess the performance of online content, understanding perceptions of my university's academic programs, identifying areas for service improvement, and creating new programs that address these needs.
Westerman et al. (2012)	Digital culture	Dimension resulting from combining digital intensity (or level of investment in technological initiatives) and digital transformation management intensity, understood as the level of investment in leadership capabilities to implement technology-based changes.

3. Materials and Methods

Due to the nature of the data required to develop the model, a field design with a mixed-methods approach (quantitative and qualitative), cross-sectional, and exploratory level was used (Malhotra, 2004). For the sample selection, non-probabilistic techniques based on the approaches of Denzin and Lincoln (2000) were applied, resulting in the sample composition shown in Table 2.

Table 2: Composition of the Sample Used for the Research.

Sample Description	Sample Size	Gender Distribution	Distribution by Field of Study	Technique (Instrument)
Students	97	55 Men (56,7%) 42 Women(43,3%)	Administration and Economy (73,2%) Engineering (24,7%) Other areas of study (2,1%)	Survey (questionnaire)
Experts	8	6 men (75%) 2 women (25%)	-	In-depth interviews

To collect student data, a preliminary model was created, consisting of 11 dimensions and 55 underlying factors. This model was developed based on theoretical contributions derived from the main dimensions that constitute the structural basis for constructing the university digital transformation model (Table 3).

Table 3: Factors implicit in each of the dimensions considered for developing the digital transformation model.

Dimensions	Factors
Institutional Strategic Framework focused on digital transformation.	• Mission and Vision, focused on digital. • Strategic objectives with an IT focus. • Positioning through digital platforms. • Student loyalty strategies with a digital focus. • Digital initiatives aligned with corporate strategy
Digital culture.	• Training focused on digital technologies. • Promotion of projects on digital topics. • Tolerance for change. • Capacity for continuous learning. • Comprehensive approach to the student experience.
Organization and structure	• Digital technologies present in organizational processes. • Digitization of administrative processes. • Digital technologies in workflows. • Digitally adaptable organizational structure. • Decision-making incorporating IT.
Critical capabilities and key resources	• Data-driven decision-making. • IT focus on student loyalty and the university brand. • IT-focused problem-solving for students. • Technologies for optimizing the organization's back office. • Services accessible anywhere, anytime.
Student Lifecycle Value	• Digitization of the student lifecycle. • Incorporation of IT for student satisfaction and retention. • Academic and pedagogical support with an IT focus. • Internships and job searches with a digital focus. • Incorporation of IT for continued studies.

Dimensions	Factors
Ecosystem (strategic partners and allies that a university should have)	• Relations with companies and corporations. • Relations with communities and social groups. • Relations with foundations/NGOs. • Relations with international universities. • Links with students and faculty at other universities.
Flexible and personalized teaching	• Incorporation of IT into students' learning patterns. • Teaching model tailored to the student's physical location. • Use of predictive data to anticipate student needs. • Individualized counseling system. • Adaptation of teaching to each student's profile.
Points of contact with the student	• Digital library. • Digital platform for student affairs. • IT support to foster work groups. • Digital cafeteria services. • Digital support for student-director-secretary relationships.
Social networks and profile research	• Analysis of positioning indicators. • Analysis of student perceptions on social media. • Identification of areas for improvement in digital services. • Recruitment of potential students through social media. • Promotion of collaborative learning on social media.
Processes of transformation of teaching for higher education	• Application of ICT in the teaching-learning process. • Training in digital pedagogical strategies. • Student life integration project - teaching strategy. • Incorporation of digital teaching strategies for family integration. • Integration of student socioeconomic status with digital teaching strategies.
Investment in IT	• Investment in learning platforms. • Quality technical support for digital processes. • Automation of teaching services for students. • Investment in administrative technology platforms. • Improvement of contact points with students through ICT.

The preliminary digital transformation model was evaluated for its relevance and practical applicability through a questionnaire that had previously been validated using the expert judgment technique, involving 40 evaluators, resulting in an overall content validity index of 0.714.

Once validated, the questionnaire was distributed via Google Forms to the 97 students who participated in the study, allowing them to indicate, using a five-point Likert scale, the degree of importance they attributed to each dimension of the digital transformation model, as well as to each intrinsic factor within those dimensions.

Additionally, eight semi-structured interviews were conducted with senior officials from the Universidad Autónoma de Chile and experts in digital transformation, who contributed their knowledge, reflections, and assessments regarding the subject of study. These interviews were recorded, transcribed, and coded by assigning conceptual categories to information segments relevant to achieving the study's objectives.

The analysis was carried out in three phases: first, a microanalysis of each interview was conducted, initiating an open coding process using Atlas.ti software. This phase provided a comprehensive understanding of the data and concluded with a broad description of each analyzed category.

In the second phase, the data obtained were grouped and classified using descriptive codes that aligned with each interview question. Through axial coding, these descriptive units were clustered into categories, and new memos were created to describe the properties of each.

Finally, in the third phase, a matrix of intensity was developed to identify meaningful relationships and patterns that informed the theoretical model of the university's digital transformation process. This model consolidates and integrates the information provided by both the students who completed the questionnaire and the interviewed experts.

4. Results

4.1. Quantitative Results

The quantitative analysis revealed an even distribution of importance across the dimensions related to digital transformation within a university. The three main factors identified in this process were all within the "Digital Culture" dimension, listed by importance as follows: continuous learning capacity (1.96%), tolerance to change (1.95%), and a holistic focus on the student experience (1.94%).

Conversely, the three least relevant factors, according to respondents, belonged to the "Social Networks and Profile Research" dimension, in descending order: analysis of student perceptions on social media (1.77%), promotion of collaborative learning through social media (1.77%), and recruitment of potential students via social media (1.76%).

4.2. Qualitative Results

The main findings from the interviews with the eight consulted experts first reflect a strong tendency to highlight the student-centered approach as fundamental in digital transformation. It was repeatedly emphasized that the key areas of digitalization are those that enable students to receive complete, accurate, timely, and relevant information about academic and administrative processes, including the digitalization of libraries and the effective use of learning platforms.

The importance of this aspect is underscored by the assertion that a university's digital maturity is closely linked to student satisfaction. However, it is acknowledged that this maturity is always relative, as it depends on user perception. Thus, digital maturity includes a subjective component that goes beyond processes, finances, and technological capacity. It was also noted that focusing on the student experience—reflecting institutional culture, strategic vision, and transition management capacity—is vital in digital transformation processes.

Another key factor in determining a university's digital maturity is IT governance, which enables the generation and implementation of digital initiatives. Additionally, indicators such as the correlation between academic performance and job placement, and the ability for students to complete academic activities from home, are also mentioned.

Interviewees identified the main drivers of digital transformation in universities as:

Corporate goals (vision, mission, strategic objectives), embedded in organizational culture and strategy, including the desire to remain at the forefront of knowledge and technology.

The commitment of all educational community members to change processes.

The learning curve acquired through the gradual development of the transformation process.

Effective communication to manage the technological foundation and decision-making.

It was argued that digital transformation requires transforming talent so that individuals clearly understand the strategic direction regarding what to retain and what to change.

From another perspective, digital maturity is seen as comprising three stages:

- Availability of digital resources
- Use of those resources
- Integration of technological platforms

Thus, indicators of digital maturity should be associated with factors that measure progress in transformation based on targeted objectives.

While interviewees agreed that Chilean universities are generally ready to begin digital transformation, they also acknowledged cultural and financial barriers, particularly the need for investment in technology. These aspects can significantly influence a university's digital maturity, along with the type of technology used, the skills

to manage it, decision-making capabilities, leadership, and change management competencies.

Cultural factors, such as generational dynamics, were also emphasized. There is a need to integrate younger faculty members with a global digital perspective and high learning capacity.

Another concern was the challenge of combining hard technical skills with soft skills, especially in the initial stages, justifying the need for constant monitoring to anticipate potential risks of failure.

Regardless of the type of institution (public or private), there was broad consensus that digital transformation must be led by the highest levels of governance (rectorate and vice-rectorates), and managed by a planning, innovation, and development office capable of mobilizing various functional areas and structuring a dedicated transformation team. Digital transformation should be seen as an institutional policy initiated by university leadership to promote innovation and integrate digital technologies throughout the institution.

Despite the human and organizational gaps in managing change, experts warned against abrupt digitalization efforts, recommending pilot projects to achieve small wins that pave the way for larger changes. Lifelong learning and leadership—particularly from IT and academic units—were identified as key enablers of the transformation process.

From these insights, three essential components of digital transformation processes can be highlighted:

- The cultural aspects that define a university's strategic decisions regarding digital infrastructure and financial resources.
- A student-centered approach for designing and managing new academic and administrative processes.
- The technical skills and leadership capacities required to manage internal processes for effective digital transformation.

4.3. Theoretical Model of Digital Transformation

Based on the findings, the digital transformation process in a university is structured into three phases:

- Availability of Digital Resources:

This includes the adoption and implementation of institutional policies and strategies related to acquiring, using, and integrating digital technologies.

- Use of Digital Resources:

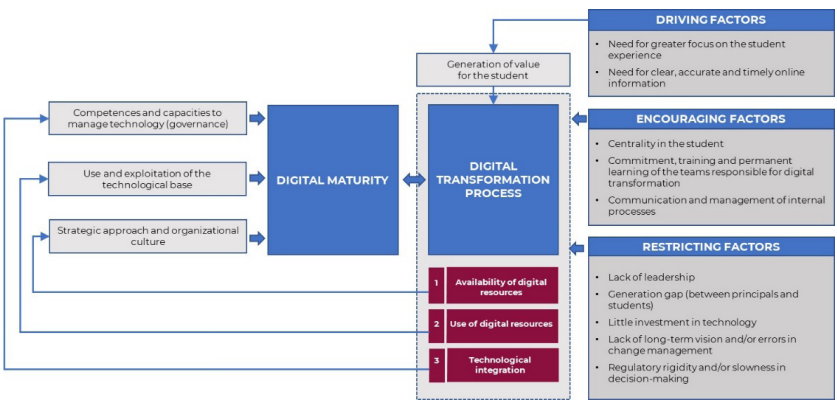
Refers to how technological infrastructure is used for academic and administrative processes. It requires recognizing the potential of new technologies and implementing initiatives to enhance student experiences, streamline internal processes, and improve competitiveness.

- Integration of Digital Technologies:

This phase focuses on connecting technology with the broader environment, developing capacities, and implementing initiatives aimed at institutional improvement by reconfiguring traditional structures, always maintaining focus on the student experience.

In this theoretical model (Figure 1), the foundation of the process is to generate greater value for the student, as the consulted experts agreed that no digitalization effort makes sense if it does not prioritize the student experience and the provision of clear, accurate, and timely information.

Figure 1: Theoretical Model of the Digital Transformation Process in a University.



5. Discussion and Conclusions

Based on the results obtained, it is emphasized that the digital transformation model of the Universidad Autónoma de Chile reflects the close relationship between digital maturity and the creation of value for the student through teaching-learning processes and economic-administrative processes. This relationship is linked to three main factors: (1) the strategic approach and organizational culture; (2) the use and exploitation of the available technological base; and (3) the competencies and skills demonstrated to handle technology.

These three elements, determinants of the success of the university's digital transformation process, require the student to be considered the focal point in decision-making, but also require commitment, training, and continuous learning from the people responsible for managing technological change. This, in turn, demands clear leadership, as well as adequate communication and coordination between the academic-administrative areas responsible for managing the processes carried out in the institution.

This seems to be condensed in what Pelletier and Hutt (2021) define when they state that digital transformation is: "a series of profound and coordinated changes in culture, workforce, and technology that enable new educational and operational models and transform the business model, strategic directions, and value proposition of an institution" (p. 30), implying the need for innovative leadership at all levels of the institution, as well as coordination among the different units.

In this regard, any effort to change towards the digitalization of university systems and processes requires a prior recognition of the university model that is aspired to; of course, within a digital logic and in harmony with the social mission of the university. This will not only boost the mechanisms that guarantee higher educational quality but also ensure a transformation process that takes into account the digital competencies (current and desired) of students, teachers, and those responsible for gradually incorporating technologies into academic-administrative processes, facing the challenges posed by digitalization, and consolidating regional, national, and supranational alliances that will support the initiation of other disruptive processes that

consciously allow anticipation of new scenarios arising from scientific and technological advances in the global context.

Thus, the financial difficulties a university may face, its cultural tradition, regulatory rigidity, lack of a clear vision of what is intended to be achieved through the digital transformation process, and the errors that may occur both in change management and in the implementation of new technologies are factors that could not only reduce the institutional capacity to implement technological changes but could also have contradictory effects on the economic and social dimensions of the university's sustainability strategy.

On the other hand, the model design verifies what Xiao (2019) has highlighted when arguing that digitalization, as perceived by universities in China and other countries, seems to be oriented towards the instrumental creation of digital campuses and the development of innovations in academic processes, but lacks sufficient incentives for digital technologies to improve research capacity and serve a wider community. In fact, during the data collection process, none of the experts consulted mentioned the improvement of scientific activity, understood as one of the substantive activities of universities. This aspect was not reflected in any of the models used as the basis for building the Universidad Autónoma de Chile's digital transformation theoretical model, which warrants further studies to determine why, in the case of higher education, this transformation process appears to be confined to the internal context of institutions.

In this sense, within IT governance, as the dimension of the process of transformation that contributes most to the digital maturity of a university (21.96%), it is necessary to clarify how the institution's digital structure allows alignment of strategic, technical, and logistical needs with the redefinition of the roles of administrative staff, faculty, and students, in order to promote the continuous innovation of services and processes, and create new digital learning spaces centered on the student.

This would lead to future studies attempting to clarify potential issues and needs arising from the new technological interactions that will take place within the university, as well as the identification of new opportunities offered by these connections in the context of university social responsibility.

Based on the findings presented in this study, the following conclusions are drawn:

- The digital maturity of the Universidad Autónoma de Chile will be mainly determined by how the available technological resources are utilized and the ability to integrate different technologies.
- The way information technology is managed (IT governance) is the dimension that most contributes to achieving the university's digital maturity.
- The digital maturity of the university is a variable closely interconnected with the digital transformation process, which is influenced by: (1) the skills and abilities to manage technology; (2) the use and exploitation of the technological base; and (3) the organizational culture and strategic approach of the institution.
- The factors that facilitate the digital transformation process in the university are: (1) the student-centered approach; (2) continuous learning and commitment demonstrated by the entities responsible for carrying out the process; and (3) effective coordination and management of processes carried out in the involved areas.
- The main factors that could hinder the implementation of the digital transformation process in the university are: (1) lack of leadership and short-term vision; (2) slow decision-making processes; (3) generational gap between teachers and students; and (4) insufficient investment in the technological base.

Having reached these conclusions and considering the exploratory nature of this research, it is recommended to conduct new studies to verify the consistency, reliability, and validity of the university's digital transformation model, suggesting the use of structural equation modeling. In any case, even if the model presented in this article is validated, it is recommended to determine its impact on students before implementation. For this purpose, the Student Satisfaction Index model proposed by Turkyilmaz et al. (2018) can be used.

Additionally, considering the findings reported, new questions arise that deserve to be answered from a scientific perspective. For example, one area of possible research would be to analyze the influence of organizational routines on the adoption of an organizational culture

aligned with the demands of the digital ecosystem in the context of higher education, and assess the potential impact of digital transformation on the university's sustainability.

From a non-scientific perspective, it is suggested that those responsible for managing the implementation of the digital transformation model in the university consider the influence of power relations during the transition process towards digital transformation, as this will affect the coordination of internal processes associated with information management, the actions of people with technical and management responsibilities, faculty performance, and student confidence in future academic and administrative processes.

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