Assessment Model for Digital Services provided by Higher Education Institutions

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ABSTRACT

This paper explores the concept of introducing digital government in higher education institutions (HEI), mainly universities. In particular, it introduces the concept of University Digital Government (UDG), proposes a classification of core university digital services (UD-services) offered by such institutions to their community members, and defines a maturity model for assessing university academic units in terms of the maturity level of their UD-services. The research work relies on case studies in Argentina. The model considers possible delivery channels for each type of service and based on the service and the channels, it defines the maximum level of maturity that could be reached. Based on an assessment of how services are delivered by academic units, a scale is established for measuring the status of UDG development in a given academic unit. The model was applied in nine universities in Argentina and the results obtained are discussed in the paper. The main contribution of the proposed model is to serve as a road map illustrating and guiding academic units in their efforts on applying digital technologies to improve the quality of their services.

CCS Concepts

• **Applied computing** • **Computers in other domains** • **Computing in Government → E-government**

Keywords

"Digital Government", "Service Quality Model", "Quality Assessment", "University Digital Government", "University Service"

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1 INTRODUCTION

Digital Government (DG) refers to "the use of digital technologies, as an integrated part of governments' modernization strategies, to create public value. It relies on a digital government ecosystem comprised of government actors, non-governmental organizations, businesses, citizens' associations and individuals which supports the production of and access to data, services and content through interactions with the government" [8]. Given the evolution observed in DG initiatives, the model proposed in [9] defines contextualization as the latest stage of such evolution. Contextualization "aims at Digital Government supporting specific efforts by countries, cities, communities and other territorial and social units to develop themselves" [9]. At this stage, DG initiatives focuses on delivering outcomes and benefits considering different local and sectorial needs, like those designed to improve the quality of lives of residents of a given city, as well as DG initiatives focusing on delivering specific benefits in areas like education, health, transport, and other sectors. In particular, in the education domain, this paper analyzes the maturity possessed by academic units of higher education institutions for delivering services to its community members.

Even though the state of the art in DG has progressed significantly in the past two decades, there is still scarce research in studying DG at the education level. To illustrate, a search conducted in Scopus database on November 2018 with the keywords "(digital and government) and (university or universities) and (services)" produced 260 results, and a similar search using "(electronic and government)" instead of "(digital and government)" produced 346 results. In addition, as highlighted in [3], limited progress has been achieved in the application of DG concepts, methods, and tools to the university context.

In line with the above identified research gap, this paper aims at exploring the contextualization of digital government initiatives for the educational sector. Thus, it explores two research questions – 1) how HEI academic units can leverage on digital government initiatives to improve their services? and 2) how to measure their progress in improving UD-services?. To address the research questions, the paper introduces the concepts of UDG and UD-service. In addition, it identifies a number of core UD-services considering those provided by universities to their community members in Argentina, and proposes a model for assessing the maturity of UDG achieved by academic units. The model enables to assess an academic unit based on the services it offers and the channels applied for delivering such services. Considering the assessment results and the possible maximum maturity level that the services can achieve, the maturity of DG evolution for the academic unit is calculated. Main contributions of this paper include introducing the concepts of UDG and UD-Service, and the model proposed for assessing the maturity of higher education institution digital services[1].

The remaining sections of this paper are organized as follows. Section 2 explains some background related to Argentinian Universities illustrating the context underpinning the research work. Section 3 discusses some related work; while Section 4, the methodology applied for conducting the research work. Section 5 presents the UDG and UDG-service concepts; Section 6, the proposed assessment model; while Section 7, the results obtained for applying the model in nine universities in Argentina. Finally, Section 8 draws conclusions and future work.

2 UNIVERSITIES IN ARGENTINA

In Argentina, the Higher Education Law [2] establishes that university institutions shall have academic and institutional autonomy. Among its responsibilities, they must produce their own bylaws and establish their governance bodies, including an individual member with an executive role, and two governance bodies – the High Council and the Assembly; comprising different number of representatives from the university community, i.e. representatives from the academic and administrative staff, graduates and students. The representatives of the governance bodies are chosen democratically by the academic units. The person holding the highest executive power is called the University President or Rector; is elected by the members of the Higher Council or by the Assembly as established in the bylaws of each university, and is part of the High Council.

According to the Higher Education Law (HEL) and their own academic and institutional autonomy, each university must define its own by-laws and government bodies. In addition, the HEL defines the concept of University Governance as the practice of the political, financial and administrative authority as regards the affairs of a higher education institution taking into account the interests of its community members and the practice of its rights and duties" [4].

2.1 Organizational Structures

Each university defines its organizational structure; generally, the structures may comprise faculties or departments, and primary and secondary schools. For example, the structure of two national universities is the following:

- *Universidad Nacional de La Plata (UNLP)* – comprises seventeen faculties, each of them has academic autonomy. Thus, faculties can define their own academic calendar and organizational structures for their courses, hire staff, and manage their internal budget, among other aspects [3].
- *Universidad Nacional del Sur (UNS)* – comprises sixteen departments, each of them is responsible for defining the organizational structure for their courses, hiring staff, but the academic calendar is defined by the University for all departments[4].

According to the university structure, in some cases, the scope of the governments are more restrictive, but with economic autonomy to provide services to its community. In order to standardize the various terms that are used, such as school, faculty, department, we adopt the name of "academic unit". Focusing on university services, an academic unit refers to a university organizational structure – such as faculty, school, department, or other; with autonomy to regulate policies for the services it provides" [3].

2.2 University Services

Like governments, who deliver services to address the needs of their constituencies, universities provide services to satisfy needs of their community members. Inspired by the definition of public service – a service which is provided by government to people living within its jurisdiction, either directly through the public sector or by financing the provision of services [10], we define university service. A University Service is the result of a process carried out by a university or by another organization, that is controlled and regulated by the university, aiming at delivering value by satisfying the needs of the its community members. In particular, university community members include students, graduates, lecturers, and administrative staff. Examples of services delivered to them are shown Table 1.

Table 1: University services - examples

Service Type	Recipient	Example
U2S	Students	Enrollment in a course
U2L	Lecturers	List of students enrolled in a course
U2G	Graduates	Information about postgraduate courses
U2A	Administrative Staff	Information about new administrative position

The responsibility and the scope of university services are determined by the laws of each university. For instance, in UNS,

the dates of the academic year are defined by the university and the departments must conform to it; while in UNLP, the academic year is defined by each of the faculties, independently.

RELATED WORK

As mentioned in the Introduction section there is very scarce related work on digital government applied to the university context. In [3], publications related to e-government in university fields are identified and analyzed. The paper shows the result of scientific publications appearing between 2010 and 2015, containing the keywords "e-government", "electronic government", or "digital government" in the title, abstract and keywords. The search was later refined to papers addressing any kind of university-related problem. Results showed that the work in the area is scarce. Additionally, an updated search conducted on 31st January 2019 produced some few more papers. However, most of them are not related since they refer to studies conducted by universities in the field of digital government. The only exception is the following. Vasconcelos, et.al [11] argues that most Brazilian federal universities do not fully comply with digital government standards and fail to deliver software that meets the requirements and expectations from stakeholders, institutions, and the federal government. Their research work explains main differences between actors and business processes proposed in software product management reference models and those existing in Brazilian public universities.

3 RESEARCH METHODOLOGY

The research work is guided by two research questions: R1) How HEI academic units can leverage on digital government initiatives to improve their services? R2) How to measure progress of HEI academic units in improving UD-services? The research work has been conducted using primary and secondary data. Primary data was collected through an online survey responded by nine national universities and five interviews conducted with administrative and academic staff of four national universities, all in Argentina. Data was collected from July to October 2018. Secondary data from conference and journal articles as well as specialized books was used to identify the research gap (see Section 3) underpinning the research questions and to understand background concepts and the state of art on quality assessment models (see Section 5). The knowledge obtained from the collected data was used to develop the proposed model (See Section 6). Finally, the model was validated through nine universities in Argentina (see Section 7) [2].

4 UNIVERSITY DIGITAL GOVERNMENT

University government bodies include members, like educators, administrative staff, students, and graduates, who play different roles in the university, and as a whole, they constitute the university community. They carry out activities in accordance to regulations set forth by the university government bodies. To satisfy the community members´ needs and following the regulations, each university offers a set of services. Currently, several of such services are provided through digital technologies.

The concept of University Digital Government (UDG) is defined as the use of digital technologies as a tool to improve services provided by a university to its community members while at the same time transforming the interactions between the institution and its community members.

We recall the definition of University Service provided in Section 2.2, as the result of a process carried out by a university or by another organization that is controlled and regulated by the university, aiming at delivering value by satisfying the needs of its community members. University services can be classified according to various criteria. On the one hand, they can be categorized based on the recipient as: U2S (services to students), U2L (to lecturers), U2G (to graduates) and U2A (to administrative staff). On the other hand, they can be classified based on the type of business process supporting the service. Considering this and inspired by [11], university services can be:

- *Informational* – providing relevant information to university community members; for instance, informing the relevant dates of the academic year to students and lecturers.
- *Certification* – declaring and certifying different states concerning the status of the university community members; for instance, certifying that a student has approved a course.
- *Control* – enabling academic units to be responsible for the right use of resources and giving faithful compliance of regulations, generally controlling the behavior of community members; for instance, checking the attendance of students, lecturers or administrative staff.
- *Authorization* – granting permissions or authorizations to conduct certain activities; for instance, authorizing an academic unit to open a new administrative position.

Service delivery is part of the service business process where interactions between the service supplier and the service recipient is carried out. In service delivery, the delivery channel refers to the mean used to support such interactions. More precisely, the delivery channel refers to the perception of how the service is delivered according to the service recipient, more than to the means itself. For example, a student can interact with an academic unit by phone calls that are answered by an administrative staff or by phone calls that are responded automatically by an Interactive Voice Response (IVR) system. While in both scenarios the recipient communicates through a telephone line, the student´s perception of how the service is delivered may differ significantly if the call is responded by a person or by an IVR system.

A service delivery strategy represents a group of decisions made by the service provider affecting how the service will be delivered. Examples of such decisions include, selecting the delivery channels for each service, the days/hours in which the services will be offered through each channel, and the cost of accessing the service through a given channel, among others. As part of the service delivery strategy, university services can be

offered through various channels. The so called "traditional channels" refer to those where interactions are manually supported, such as the counter, where actors interact face to face, or the phone. When the interactions between the service provider and service recipients take place through a channel that is supported by digital technologies, the service is called a digital service.

Table 2: Digital channels – examples and features

CHANNEL	REQUIRES IDENTIFICATION OF THE SERVICE RECIPIENT?	INTERACTIONS ARE MANUALLY OR AUTOMATICALLY SUPPORTED?
Website	both (yes or no) depending on the service	automatically
Web App	usually yes	automatically
Mail	yes	both (manually and automatically)
SMS	yes	both (manually and automatically)
IM	yes	both (manually and automatically)
Mobile APP	usually yes	automatically
Facebook	yes	both (manually and automatically)
Twitter	yes	both (manually and automatically)

Table 3: Digital channels – examples and features

CHANNEL	COMMUNICATION STYLE	DESCRIPTION
Website	Asynchronous	Information is published on the website and can be read by several users at any moment.
Web App	Synchronous	The user requests an action, different types of messages may be exchanged and the result of the operation can be registered.
Mail	Asynchronous	Messages are exchanged asynchronously and are kept until they are processed by the users. All messages are registered.
SMS	Asynchronous	Messages are exchanged asynchronously and are kept until they are processed by the users. All messages are registered.
IM (WhatsApp)	Asynchronous	Messages are exchanged asynchronously and are kept until they are processed by the users. All messages are registered.
Mobile APP	Synchronous	The user requests an action, different types of messages may be exchanged and the result of the operation can be registered.
Facebook	Asynchronous	Information is published and can be read by several users at any moment. Messages are exchanged asynchronously and are kept until they are processed by the users. All messages are registered.
Twitter	Asynchronous	Information is published and can be read by several users at any moment. Messages are exchanged asynchronously and are kept until they are processed by the users. All messages are registered.

Currently, institutions use a wide range of digital channels to deliver their services. In addition, digital channels can be configured in various ways offering different type of functionality. For example, service recipients may need or may not need to identify themselves for accessing the service, the interactions between service recipient and service provider can be manually or automatically supported, etc. Main channels and their features are shown in Table 2.

Delivery channels can also be classified as synchronous and asynchronous, depending on the communication style. Synchronous channels enable service recipients to obtain responses to their interactions immediately; while asynchronous channels allows the user to send a petition which will be responded by the other actor at a later time. The main purpose of this channel classification is to understand the timeliness of responses for the various types of requests issued by service recipients. The proposed model uses the timeliness of responses to assess the service maturity level. Table 3 illustrates main channels and their classification according to the communication style.

In addition, UD-services can be classified according to their maturity level, measuring the level in which digital technologies are used to transform the business process underpinning the delivery of the service. Based on [12], the following categories are identified:

- *Emerging* – informational services about university policies, governance, regulations, and relevant

information about how to apply for university services. They can also provide links to other academic and administrative units as well as to other universities.

- *Enhanced* – services enabling two-way communication with service recipients, allowing to download forms, to conduct searches, offering audio and video resources, and information in more than one language, among other functionality.
- *Transactional* – services facilitating the completion of a whole transaction online. In some services, an authentication mechanism is required to verify the service recipient´s identity for successfully completing the transaction. Examples include services related to non-financial transactions, such as filling enrollment forms and applying for authorizations, as well as those requesting payments, such as requesting a paid certificate and doing the payment.
- *Integrated* – a set of related services are proactively offered as a package based on the needs of the service recipients; for example, at the beginning of the semester, students are automatically enrolled in the set of courses corresponding to the plan of their degree program, informed about their enrollment as well as of the relevant dates for the academic semester, among others. At this stage, services are seamlessly delivered collaboratively among various academic and administrative university units.

Analyzing the concepts discussed in this section – type of service business process, communication style of the delivery channel and service maturity level, we argue that the highest maturity level that a service can reach depends on the type of business process and the delivery channel communication style. For example, informational services can be delivered through synchronous or asynchronous channels and the highest maturity level they can reach is emerging, since they just provide information in one way, usually from the service provider to service recipients. In the case of certification, control and authorization services, the enhanced and transactional level can be reached using asynchronous services. In this case, since some kind of (manual or automatic) asynchronous action is required to complete the service delivery, services are not delivered seamlessly and thus, the integrated level cannot be achieved. For synchronous channels, such services can be delivered at the transactional level (completing the whole transaction online) or at the integrated level (a set of services proactively and seamlessly delivered). The level of maturity for each type of service considering the communication style of the delivery channel is shown in Table 4.

5 ASSESSMENT MODEL FOR UD-SERVICES

The proposed assessment model aims at defining a maturity level of service delivery for an HEI academic unit. The model was developed following five stages: 1) identifying core services, 2) classifying core services, 3) defining service maturity levels, 4) designing the assessment instrument, and 5) assessing the maturity level of an academic unit. Each stage is explained in the following five sections, respectively.

Table 4: Highest maturity level considering type of service and delivery channel

	Delivery channel communication style	
TYPE OF SERVICE BUSINESS PROCESS	SYNCHRONOUS	ASYNCHRONOUS
INFORMATIONAL	Emerging	Emerging
CERTIFICATION	Transactional / Integrated	Enhanced /Transactional
CONTROL	Transactional / Integrated	Enhanced /Transactional
AUTHORIZATION	Transactional / Integrated	Enhanced /Transactional

Identifying Core Services

To standardize the variety of services delivered by autonomous universities in Argentina, we first identified a set of core services delivered by academic units to community members. The identified core services satisfy the basic needs, providing information about courses, enrolling students to courses and final exams, granting access to infrastructure, like to classrooms, guaranteeing the appointment of staff to new positions, and electing representatives in the corresponding university government bodies. Based on the interviews conducted with academic and administrative staff of three universities in Argentina – Universidad Nacional de La Plata, Universidad Nacional del Sur, and Universidad Nacional del Noroeste de la Provincia de Buenos Aires, which are organized by faculties, departments and schools, respectively, we identified the most relevant needs of their community members and defined the core services as explained below.

For students, an academic unit must provide them the necessary information to attend courses, validate the academic requirements that students need to fulfill for attending a given course or to complete a final exam, keep records of student´s marks, provide the requested certificates, and allow them to vote their representatives. Thus, the eight identified core services for students include: 1) providing information about academic year; 2) enrolling in a course, 3) enrolling in a final exam, 4) issuing academic history records, 5) issuing certificate of regular student, 6) providing information about course timetable and classrooms, 7) providing information about library books, and 8) voting students´ representatives.

To lecturers, an academic unit must provide them information about the academic requirements for the students to be authorized to attend a given course, classrooms to teach courses, provide information about new positions, provide tools to fulfill their duties, and allow them to vote their representatives. Thus, the

eight identified core services to lecturers include: 1) managing students enrolled in a course, 2) managing students enrolled in a final exam, 3) managing classrooms for regular courses, 4) providing information about new academic positions, 5) managing appointments of lecturers, 6) managing attendance of lecturers; 7) managing leaves of lecturers, and 8) voting lecturers´ representatives.

To graduates, academic units must provide information about postgraduate courses, validate the academic requirements that students needs to fulfill to enroll in a postgraduate course, register the student´s marks, and enable them to vote their representatives. Thus, the four identified core services to graduates include: 1) providing information about postgraduate courses, 2) enrolling in a postgraduate course, 3) issuing a certificate for a postgraduate course, and 4) voting for graduates' representatives.

To the administrative staff, academic units must provide information about new positions, provide tools for them to conduct their duties, and enable them to vote their representatives. Thus, the five identified core services to administrative staff include: 1) providing information about a new administrative position, 2) managing appointments of administrative staff, 3) managing attendance of administrative staff; 4) managing leaves of administrative staff, and 5) voting administrative staff´s representatives.

Given that academic units apply different vocabularies for naming and defining services, the list of core identified services was standardized in terms of service names and functionality. The list of services is summarized in Table 5.

5.1 Core Services

The identified core services were classified according to the service type. Mainly, informational services include providing information about the academic year, course timetables and classrooms, library books, and new positions for academic and administrative staff. Certification services comprises those issuing academic history records, certificates of regular student, and certificates for a postgraduate course. Control services refer to managing the attendance and leaves of academic and administrative staff. Authorization services involve enrolling in a course, postgraduate course, and final exam, managing students enrolled in a course and in final exams, managing classrooms, and appointments of academic and administrative staff, and voting for representatives. The classification is shown in Table 6.

5.2 Defining Service Maturity Model

After the identification and classification of core UD-services, the next phase comprises defining a reference model specifying for each type of service, the basic functionality that needs to be provided for each maturity stage. For example, in the case of a *Certification* service delivered using a *synchronous channel*, the service will be delivered at the *Emergent* stage if relevant service-related information is provided; at the *Enhanced* stage if it fulfills the Emergent stage and in addition, the application to the certificate can be done online, and the reception of the application is acknowledged immediately. The service reaches the maturity of *Transactional*, if it fulfills all the requirements of the Enhanced stage and the certificate is delivered online immediately upon request. Finally, the certificate service is at the *Integrated* maturity stage, when it fulfills the Transactional stage, the certificate requires approval from more than one academic unit and the certificate is delivered online and seamlessly upon request The complete reference model is shown in Table 7.

Table 5: List of core identified UD-services

SERVICES TO STUDENTS	SERVICES TO LECTURERS
1) providing information about academic year 2) enrolling in a course 3) enrolling in a final exam 4) issuing academic history records 5) issuing certificate of regular student 6) providing course timetable & classrooms info 7) providing information about library books 8) voting students´ representatives	1) managing students enrolled in a course 2) managing students enrolled in final exam 3) managing classrooms for regular courses 4) providing info of new academic positions 5) managing appointments of lecturers 6) managing attendance of lecturers 7) managing leaves of lecturers 8) voting lecturers´ representatives
SERVICES TO GRADUATES	**SERVICES TO ADMINISTRATIVE STAFF**
1) providing info about postgraduate courses 2) enrolling in a postgraduate course 3) issuing a certificate for a postgraduate course 4) voting graduates' representatives	1) providing info of a new admin position 2) managing appointments of admin staff 3) managing attendance of administrative staff 4) managing leaves of administrative staff 5) voting admin staff´s representatives

Table 6: Classification of core UD-services

SERVICE TYPE	RECIPIENT	SERVICE
INFORMATIONAL	Students	○ Providing information about academic year ○ Providing course timetable & classrooms info ○ Providing information about library books
	Lecturers	○ Providing info a new academic positions
	Graduates	○ Providing information about postgraduate course
	Admin Staff	○ Providing information of a new admin positions
CERTIFICATION	Students	○ Issuing academic history records ○ Issuing certificate of regular student
	Graduates	○ Issuing a certificate for a postgraduate course
CONTROL	Lecturers	○ Managing attendance of lecturers ○ Managing leaves of lecturers
	Administrative Staff	○ Managing attendance of administrative staff ○ Managing leaves of administrative staff
AUTHORIZATION	Students	○ Enrolling in a course ○ Enrolling in a final exam ○ Voting students´ representatives
	Graduates	○ Enrolling in a postgraduate course ○ Voting graduates´ representatives
	Lecturers	○ Managing students enrolled in a course ○ Managing students enrolled in a final exam ○ Managing classrooms for regular courses ○ Managing appointments of lecturers ○ Voting lecturers´ representatives
	Administrative Staff	○ Managing appointments of administrative staff ○ Voting administrative staff´s representatives

Designing the assessment instrument

An assessment online instrument was developed using the LimeSurvey[1] tool. The instrument collects data for the 25 core services. For each service, the user shall indicate the delivery channels. The channels include website, web-app, mail, SMS, Whatsapp, mobile-app, Facebook, and Twitter. For Certification, Control, and Authorization services, the respondent should indicate the channels and whether the communication style is synchronous or asynchronous. For the Certification and Authorization services a question asks whether the business process for delivering the service can be completed at once. If the response is affirmative, another question enquires whether the service is delivered through an online system or a mobile application. Otherwise, the questions inquire about the delivery channels that can be used to request the service and the channels that can be used to complete the service process. In all the cases, the option "counter" (as an example of traditional channel) can be selected. This option indicates that the service can be delivered through face-to-face interactions.

[1] Lime Survey, online open software tool, https://www.limesurvey.org/

Table 7: Service Maturity Assessment – reference model

Maturity Level					
		Emergent	Enhanced	Transactional	Integrated
Informational	Synchronous	Relevant service-related information is provided	----	----	–-----
	Asynchronous	Relevant service-related information is provided	----	----	----
Certifications	Synchronous	Relevant service-related information is provided	The application to the certificate is done online The reception of the application is acknowledged immediately	The certificate is delivered online immediately upon request	The certificate requires approval from more than one academic unit and the certificate is delivered online and seamlessly upon request
	Asynchronous	Relevant service-related information is provided	The application to the certificate is done online The user receives a message when the certificate is ready	The certificate is delivered online but not immediately upon request	The certificate requires approval from more than one academic unit and the certificate is delivered online and seamlessly but not immediately after the request
Control	Synchronous	Relevant service-related information is provided	The application to the control is done online The reception of the application is acknowledged immediately	The control is conducted online upon request and the user is acknowledged about the result immediately	The control involves more than one academic unit, is performed collaboratively among all and the response is immediate upon request
	Asynchronous	Relevant service-related information is provided	The application to the control is done online The user receives a message when the control is ready	The control is delivered online but the result is not communicated immediately upon the request	The control involves more than one academic unit, is performed collaboratively among all and the response is delivered online but not immediately upon request
Authorization	Synchronous	Relevant service-related information is provided	The application to the authorization is done online The reception of the application is acknowledged immediately	The authorization is conducted online upon request and the user receives the result of the authorization immediately	The authorization involves more than one academic unit, is performed collaboratively among all, and the response is immediate upon request
	Asynchronous	Relevant service-related information is provided	The application to the authorization is done online The user receives a message when the authorization is ready	The result of the authorization is delivered online but not immediately upon request	The authorization involves more than one academic unit, is performed collaboratively among all and the response is delivered online but not immediately upon request

Assessing the maturity level of an Academic Unit

After collecting data through the online instrument about the functionality offered by UD-Services, the level of DG maturity of the academic unit is determined by analyzing the level obtained for the core services according to the highest level expected for the service. The result of this analysis can produce a roadmap defining the improvements that the academic unit must address so that it can improve or upgrade the maturity level of its services.

APPLYING THE MODEL

Nine academic unites were invited to participate in the exercise for applying the model and all invited units accepted. Thus, the model was applied in nine faculties or universities in Argentina: 1) Faculty of Economics, Universidad Nacional de La Plata (UNLP), 2) Faculty of Chemistry and Natural Sciences, Universidad Nacional de Misiones, 3) Faculty of Exact and Natural Sciences and Surveying, UNLP, 4) Faculty of Informatics, UNLP, 5) Faculty of Engineering, UNLP, 6) Universidad Nacional Arturo Jauretche, 7) Universidad Nacional del Noroeste de la Provincia de Buenos Aires (UNNOBA), 8) Regional Faculty San Francisco, Universidad Tecnológica Nacional (UTN), and 9) Faculty of Humanities and Educational Sciences, UNLP.

For those services that were delivered only through the counter (through face-to-face interactions) data was not collected, since they do not constitute a UD-service and therefore the maturity stage of digitization cannot be assessed.

Table 8: Applying the model – number of services per maturity stage

UA	INFORMATIONAL	CERTIFICATION	CONTROL	AUTHORIZATION
1	6E	2T	1T	2I 4T
2	6E	2T	1T	6T
3	6E	1T	1T	2I 4T
4	6E	1I 2T	1T	2I 3T
5	6E	2T	1T	2I 4T
6	6E	0	1T	2I 2T
7	6E	3T	2T	9T
8	5E	0	0	2I 4T
9	6 E	1I 1T	0	2I 3T

Table 8 presents the amount of services that have obtained the Emergent (E) level, Enhanced (I) and Transactional (T) for each of the academic units. The Integrated level was dismissed since none of the services, at any academic unit, was delivered at this stage. 6 out of 9 of the analyzed academic units had all the services of the Informational services at the Emergent level. As for Control services, 7 academic units have at least 1 out of 2 services in the Transactional level; only 1 academic unit obtained all two services in that level. Regarding the Certification services, 1 academic unit obtained all 3 services in the Transactional level. Four academic units have two services at the Enhanced level, besides 1 out of those 4 obtained 2 services at the Enhanced level. Regarding the Authorization type, 1 academic unit obtained all 9 services and another one 6 services at the Transactional level, and the last 7 academic units obtained an average of 2 services in Enhanced level and, at least, 3 at the Transactional level.

CONCLUSIONS

The paper introduced the concepts of University Digital Government (UDG) and University Digital Service (UD-service). In addition, a model was proposed for assessing the maturity level of HEI academic units in delivering UD-services. As part of the model, a set of 25 core services were identified. Such services must be provided by any academic unit to guarantee the fulfillment of its mission. The maturity level of each service is assessed based on the type of service and the communication channel through which it is delivered. An assessment instrument was developed enabling to assess UD-services. After analyzing the results, it was possible to determine the level of maturity of the services provided, and determine if they are among the maximum levels proposed by the model. Based on this, academic units can draw a roadmap for improving the maturity and enhancing their services.

Regarding the formulated research questions, the first one refers to how HEI academic units can leverage on digital government initiatives to improve their services. Responding to this question, we argue that the proposed model provides a reference for assessing the current status of service digitization of an academic unit. It also enables to draw a roadmap on future improvements comparing the current status of service digitization with the pre-defined functionality specified in the reference model for each core service. The second research question addresses how to measure the progress of academic units in improving UD-services. By using the proposed model to analyze the current status of digitization and by defining a roadmap of possible improvements, it is possible for academic units to measure progress in the enhancement of their services.

One limitation of our work is the number of academic units in which the model was applied. Currently, there are 131 universities in Argentina, out of them 61 are government-funded, public and free. According to their structures, they can be organized into faculties, departments, and schools. This means that there are close to thousands academic units potentially interested in adopting the model. Given the time for producing this publication, the model was applied in five academic units of the UNLP, second biggest university in the country, and in other four national universities located in different provinces. As part of future, moreover already current, work, we are negotiating agreements to apply the model with several academic units.

In addition to the point discussed above, our future work includes extending the scope of core services, defining automated tools to support the definition of roadmaps for service improvements, and establishing a repository of good practices and software solutions underpinning the delivery of each UD-service.

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