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Digital Transformation of Philippine Higher Education

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Acknowledgements

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Abbreviations

3D	three-dimensional
₱	Philippine peso
4IR	Fourth Industrial Revolution
AACCUP AB	Accrediting Agency of Chartered Colleges and Universities in the Philippines advisory board
ABET	Accreditation Board for Engineering and Technology
ACBET	Accreditation and Certification Board for Engineering and Technology
ACCU-AAI	Association of Christian Schools, Colleges and Universities - Accrediting Agency, Inc.
ACCU-ACI	Association of Christian Schools, Colleges, and Universities - Accrediting Council, Inc.
AI	artificial intelligence
AI3	Asian Internet Interconnection Initiatives
ALCUCOA	Association of Local Colleges and Universities Commission on Accreditation
ALM	application lifecycle management
APAN	Asia-Pacific Advanced Network
API	application programming interface
AQAN	ASEAN Quality Assurance Network
AR	augmented reality
ASEAN	Association of Southeast Asian Nations
ASTI	Advanced Science and Technology Institute
AWS	Amazon Web Services
AY	academic year
BCM	business continuity management
BoT	board of trustees
BPM	business process management
BPMN	business process model and notation
CAD	computer-aided design
CEN	European Committee for Standardization
CENELEC	European Committee for Electrotechnical Standardization
CHED	Commission on Higher Education
CICC	Cybercrime Investigation and Coordinating Center
CICT	Commission on Information and Communications Technology
CLEVR	Collaborative Learning Environments in Virtual Reality
CMMN	case management model and notation
CMO	Commission on Higher Education memorandum order
CO	capital outlay
COD	center of development
COE	center of excellence
COOP	continuity of operations plan
COPC	certificate of program compliance
COVID	coronavirus disease
CRM	customer relationship management
CSI	CHED-supervised institution
CSS	cascading style sheets
DAG	Digital Assurance Group
DBM	Department of Budget and Management
DE	distance education
DepEd	Department of Education
DevOps	development and information technology operations
DevSecOps	development, security, and operations
DICT	Department of Information and Communications Technology
DigCompEdu	Digital Competence of Educators
DMAS	Digital Maturity Assessment Survey

DOH	Department of Health
DOLE	Department of Labor and Employment
DOST	Department of Science and Technology
DPC	Data Privacy Council
DPO	data protection officer
DRAS	digital readiness assessment survey
DRP	disaster recovery plan
DTI	Department of Trade and Industry
DTSC	Digital Transformation Steering Committee
DTU	Digital Transformation Unit
DX	digital transformation
EAC	Engineering Accreditation Commission
EDA	electronic design automation
EGMP	e-Government Masterplan
EHR	electronic health records
EQA	external quality assurance
ERP	enterprise resource planning
ETEEAP	Expanded Tertiary Education Equivalency and Accreditation
ETL	extract, transform, and load
FAAP	Federation of Accrediting Agencies
FGD	focus group discussion
FIS	Faculty Information System
G	goal
GB	gigabyte
GDP	gross domestic product
GRC	governance, risk, and compliance
HACCP	Hazard Analysis and Critical Control Point
HEI	higher education institution
HEMIS	Higher Education Management Information System
HPC	high performance computing
HR	human resources
HRD	human resource development
HRM	human resources management
HTML	HyperText Markup Language
ICE	instructor course evaluation
ICE-I	Indonesia Cyber Education Institute
ICILS	International Computer and Information Literacy Study
ICT	information and communications technology
IEA	International Association for the Evaluation of Educational Achievement
iGovPhil	Integrated Government Philippines
ILO	International Labour Organization
IMD	International Institute for Management Development
IoT	internet of things
IP	intellectual property
IPV6	Internet Protocol version 6
IRRI	International Rice Research Institute
ISA	Institutional Sustainability Assessment
ISMS	information security management system
ISO	International Organization for Standardization
ISRM	information security risk management
IT	information technology
IT&S	Information technology and services
ITU	International Telecommunication Union
IVR	interactive voice response
KPA	key performance area
KPI	key performance indicator
LGU	local government unit
LIS	library information system
LMS	learning management system
LUC	local universities and colleges
MIT	Massachusetts Institute of Technology
MITHI	Medium-Term Information and Communications Technology Harmonization Initiative

MOM	manufacturing operations management
MOOC	massive open online course
MR	mixed reality
MSME	micro, small and medium enterprise
NEDA	National Economic and Development Authority
NICTEF	National Information and Communications Technology Ecosystem Framework
NICTHS	National ICT Household Survey
NLP	natural language processing
NNQAA	National Network of Quality Assurance Agencies
NPC	National Privacy Commission
NRC	National Research Cloud
NREN	National Research and Education Network
ODeL	open and distance e-learning
ODL	open and distance learning
OECD	Organisation for Economic Co-operation and Development
OER	open education resources
OGS	other government schools
OPP	online productivity platforms
OPRKM	Office of Planning, Research, and Knowledge Management
PAASCU	Philippine Accrediting Association of Schools, Colleges and Universities
PACUCOA	Philippine Association of Colleges and Universities Commission on Accreditation
PCS	Philippine Computer Society
PDP	Philippine Development Plan
PDS	Philippine Digital Strategy
PHP	Hypertext Preprocessor
PIAAC	Program for the International Assessment of Adult Competencies
PICAB	Philippine Computer Society Information and Computing Accreditation Board
PLM	product lifecycle management
PMO	program management office
PRC	Professional Regulation Commission
PREGINET	Philippine Research, Education, and Government Information Network
PSF	Philippine Skills Framework
PSGs	policies, standards, and guidelines
PTC	Philippine Technological Council
QA	quality assurance
QDRA	Quality Reporting Document Architecture
RA	Republic Act
REN	Research and Education Network
RPA	robotic process automation
SAML	Security Assertion Markup Language
SCORM	sharable content object reference model
SDG	Sustainable Development Goal
SED	self-evaluation document
SEO	search engine optimization
SG	strategic goal
SIEM	security information and event management
SIS	student information system
SLPTE-ST	Student Loan Program for Tertiary Education Short-Term
SMS	short messaging service
SPRI	skills profiling report for individuals
SQL	structured query language
SSG	SkillsFuture Singapore
STEAM	science, technology, engineering, arts, and mathematics
STEM	science, technology, engineering, and mathematics
SUC	state universities and colleges
TA	technical assistance
Tech4Ed	Technology Empowerment for Education, Employment, Entrepreneurs, and Economic Development

TEIN3	Trans-Eurasia Information Network 3
TES	Tertiary Education Subsidy
TESDA	Technical Education and Skills Development Authority
TII	Telecommunication Infrastructure Index
TNE	transnational education
TQM	total quality management
TVET	technical-vocational education and training
UAQTE	Universal Access to Quality Tertiary Education [Act]
UAV	unmanned aerial vehicle
UCI	unique citizen identifier
UNESCO	United Nations Educational, Scientific and Cultural Organization
UI	user interface
UIS	United Nations Educational, Scientific and Cultural Organization Institute for Statistics
UN	United Nations
UNCTAD	United Nations Conference on Trade and Development
UNDESA	United Nations Department of Economic and Social Affairs
UNDP	United Nations Development Programme
UniFAST	Unified Student Financial Assistance System for Tertiary Education
UP	University of the Philippines
UPOU	University of the Philippines Open University
URL	uniform resource locator
UX	user experience
VBA	Visual Basic for Applications
VoIP	Voice over Internet Protocol
VR	virtual reality
WAN	wide area network
WB	World Bank
WBG	World Bank Group
WCAG	Web Content Accessibility Guidelines
Wi-Fi	wireless fidelity
WMS	workflow management system
XAPI	experience API
XML	Extensible Markup Language
XR	extended reality

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Context

Context

Digital transformation is an organization-wide change that "alters communication and interactions between stakeholders and reshapes the current economic, social, and political landscape" (Fischer et al. 2020 p. 2). With the fast technology development brought on by the significant change to societal patterns and processes of the 21st century, the world has gone through massive changes in the way people live and work. Today, technology is a part of most tasks in people's daily lives, from ordering products online to managing finances and posting on social media. Digital transformation leverages the opportunities of digital technologies to rethink existing processes and reimagine new ones to improve efficiency and performance (Williams & Schallmo 2018).

***AmBisyon Natin 2040* highlights digital transformation as a national priority to realize the country's ambition for prosperity.** Published in 2015, AmBisyon presents the long-term vision for the Philippines' sustainable growth in the next 25 years and calls for fiscal and legislative government action that enables economic, human, and physical capital development as well as institutional, social, and cultural development (NEDA 2022a). The digital transformation of society is critical for the realization of AmBisyon. Digital transformation of the education sector can help the modernization of the curriculum, teaching and learning methods, and materials. It can also facilitate more effective service delivery modes to enhance the quality and relevance of education and lifelong learning opportunities for Filipinos (CHED OPRKM 2022).

***The Philippine Development Plan (PDP) 2017-2022* addresses the need to invest in information and communications technology (ICT) infrastructure and connectivity, ensure security and interoperability, and set up a sound regulatory environment that promotes digital adoption, which can transition the country to a digital economy.** The PDP is the medium-term plan that supports the country's long-term vision for prosperity outlined in AmBisyon. It was updated in 2021 to take into account the impact of the pandemic that heightened the digital divide and challenges posed by the Fourth Industrial Revolution (4IR). To extend social services in far-flung areas, the updated PDP recognizes the need to improve access to a broadband internet, which can enable telecommuting, distance learning, and telehealth; support micro, small and medium enterprises (MSMEs) and online financial services; and support the *Balik Probinsya, Bagong Pag-asa Program* (Back to the Province, New Hope Program).[1] It identifies fast-tracking the government's digital connectivity program as a priority in pursuing the national digital transformation agenda. ICT policy reforms are also necessary to advance the digital connectivity agenda, allow the entry of other telecommunications players, streamline and harmonize broadband-related processes, and encourage the shared use of passive ICT infrastructure to reduce costs and increase the efficiency of service delivery (NEDA 2021a; 2021b).

The updated PDP 2017-2022 identifies multiple stakeholders that can support the digital transformation of the education sector, improve the quality of education, and prepare the future workforce with relevant skills. The PDP highlights the need to support the delivery of digital education from early childhood to adulthood to enable Filipinos to participate in 4IR. The PDP underscores the vital role of the Department of Information, Communications and Technology (DICT) in supporting the education sector promote digital literacy and upskill teachers in cybersecurity and other digital competencies. The Digital Workforce Program to be launched by DICT will build the capacity for digital technologies in the following sectors: education, finance, health, agriculture, and logistics. The Philippine Innovation Act (RA 11293), which was signed into law in 2019, also identifies digital skills training and digital economy as

[1] *The Balik Probinsya, Bagong Pag-asa Program* (Back to the Province, New Hope Program) aims to provide hope for a better future to Filipinos through equity in resources throughout the country and thereby boost countryside development. This program helps decongest Metro Manila by encouraging people, especially informal settlers, to return to their home province and assist them in this transition with support and incentives on transportation, livelihood, housing, subsistence and education, among others. https://en.balikprobinsya.ph/.

priority areas for innovation. The Act is implemented by the National Economic and Development Authority (NEDA), Department of Science and Technology (DOST), and Department of Trade and Industry (DTI) (NEDA, DOST, DTI 2020). The PDP also highlights the role of local government units, the Technical Education and Skills Development Authority (TESDA), and other relevant government agencies in ensuring the successful implementation of blended learning programs (NEDA 2021a). It also promotes a nationwide human resource development strategy for capacity building and developing the digital competencies of the future workforce in science, technology, engineering, arts, and mathematics (STEAM) and information and communications technology (ICT). Collaboration among education agencies, the private sector, and professional organizations can be used to develop accredited online, distance, and blended learning models for adult learning and continuing professional development.

The COVID-19 pandemic has accelerated the digital transformation of economies and societies globally. For over two years, local and national economies worldwide have been affected by the pandemic, resulting in elevated levels of unemployment, and widening socioeconomic inequality. Continuous disruptions and crises in public transportation, businesses, workplaces, and schools, among others, have raised awareness and demand for transformational change in the work and learning environments. The post-pandemic workforce must adapt to the new digital era to survive this wave of change.

Higher education is not immune to the challenges brought on by the pandemic, and higher education institutions (HEIs) worldwide adopted different models, technologies and methods based on their digital readiness and transformation strategies. As the pandemic forced most educational institutions to temporarily halt face-to-face learning, the adoption of digital distance learning models accelerated significantly. (See Box 1 on the impact of the pandemic.) Learning models that allow flexibility in shifting between distance and in-person experiences help institutions minimize disruptions and ensure the continuity of course delivery in potential future crises (Pelletier et al. 2021). HEIs typically implement digital transformation in three areas: (i) teaching and learning, (ii) administration, and (iii) research. Some HEIs have become early adopters and risk-takers, while others have been more conservative in changing their service delivery processes and methods. The significance and effect of digitalization in the three areas differ across institutions and countries. Nonetheless, when approached strategically, the benefits of digital transformation increasingly outnumber the challenges as a means for survival and co-existence in the digital world (Brooks & McCormack 2020). To ensure that faculty skills and literacy keep pace with technological advancements, the education sector needs to invest in supplementary faculty development, including remote capabilities for instructional design and technology support. New e-learning solutions and learner-centered course design models will be effective only when teachers understand why and how they should be used.

The Digital Transformation of Philippine Higher Education **recommends a medium-term strategy for the Commission on Higher Education (CHED).** Chapter 1 presents an overview of the Philippine higher education sector and analyzes the sectoral and country context for digital transformation of higher education. Chapter 2 discusses the foundations and pillars that support digital transformation as well as the building blocks of common and shared platforms and services for students and academic, research, and administrative stakeholders in higher education. Based on the findings in Chapter 1 and global good practices on digital transformation in Chapter 2, Chapter 3 recommends strategic goals and actions for CHED and HEIs as well as other higher education key players to digitally transform Philippine higher education.

Box 1: COVID – What has been done and what have we learned?

Pre-pandemic, the Philippine higher education sector was already using digital technologies to respond to the demand of the digital age that has changed the way people live and work. During the pandemic, the sector saw the need to use the same digital technologies to transform its teaching and learning, research, and administration. To provide Filipinos with better access to online learning, the government provided funding to enhance digital infrastructure in higher education and train faculty members. However, the investment was insufficient to upgrade the capacity of the entire higher education sector. The pandemic widened the digital divide among institutions and students. A nationwide, large, and coordinated investment in digital infrastructure is urgently needed to strengthen equitable access to higher education. Investment is also needed to build the capacity of faculty, students, and administrators to use digital technology effectively. Students may need micro-credentials for specific skills to get a job. Most importantly, a cultural transformation is needed to use technology for better service delivery, as digital transformation is more than just digitizing and digitalizing services. This report will explore these options for transforming Philippine higher education.

Situational Analysis for Digital Transformation

CHAPTER 1

Situation Analysis for Digital Transformation

This chapter reviews the following areas: (i) the current state of the Philippine higher education sector; (ii) the sectoral context of pursuing digital transformation at the sectoral and institutional levels; and (iii) the country context surrounding digital transformation of higher education. The conclusion section summarizes the policy implications of the analysis.

1.1. Overview of the Higher Education Sector

This section presents a close look at the state of the higher education sector in the Philippines. First, it provides an overview of the sector, i.e., enrollment and types of institutions. Second, it describes the role of CHED in managing the higher education sector. Third, it reviews public financing. Fourth, it discusses the overall external and internal quality assurance systems as well as the newly introduced guidelines for flexible learning to ensure the quality of online learning.

1.1.1. State of Higher Education

The higher education sector in the Philippines has expanded significantly over the past 15 years. Between the academic year (AY) 2006-07 and AY 2019-20, the number of higher education institutions grew by almost 20 percent. In AY 2019-20, there were 2,396 HEIs in total (Table 1). Public HEIs consist of state universities and colleges (SUCs), local universities and colleges (LUCs), other government schools (OGS). Private HEIs are automatically categorized as regulated institutions until they apply and pass CHED's evaluation as autonomous or deregulated HEIs (see Annex 1 for the definition of the categories).

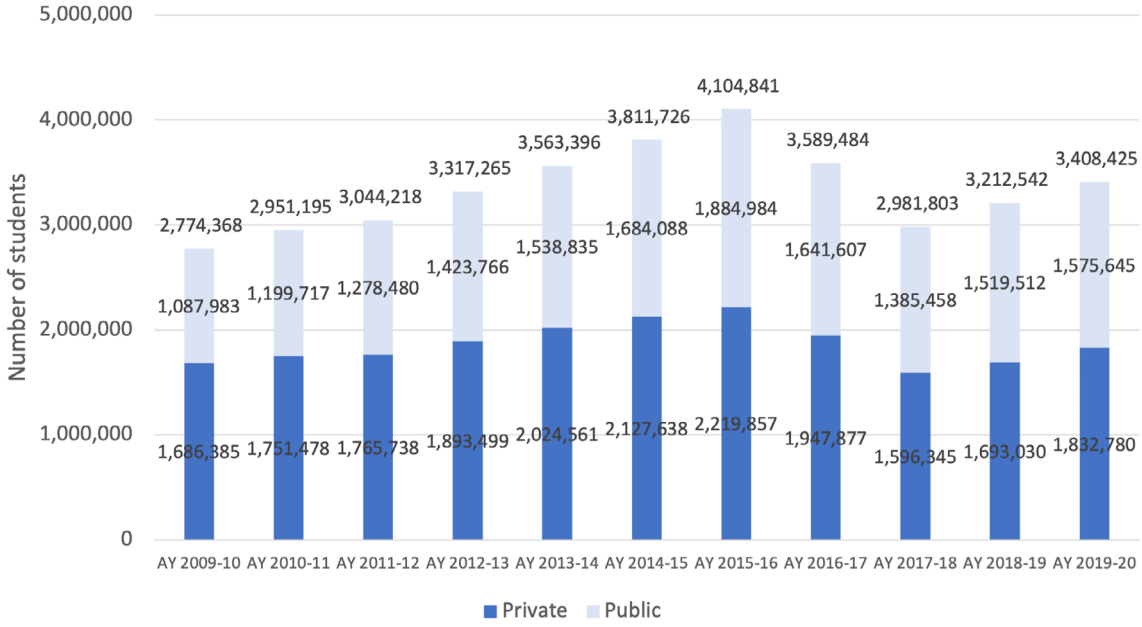
Table 1. Number of HEIs in the Philippines by Category, AY 2019-20

CATEGORY OF HEIS	NO. OF HEIS	PERCENTAGE
Public	**667**	**27.8**
State Universities and Colleges	112	4.7
SUCs Satellite Campuses	421	17.6
Local Universities and Colleges	121	5.1
Others (OGS, CHED-Supervised HEIs, Special HEIs)	13	0.5
Private	**1,729**	**72.2**
Autonomous	71	3.0
Deregulated	16	0.7
Regulated	1,642	68.5
Total (including SUCs satellite campuses)	**2,396**	**100**

Source: Latest available data, CHED 2020a; 2021a.
Note: These numbers are based on the latest available statistics on the CHED website as of May 4, 2022, and CMO No. 7, Series of 2021 that extends the validity period of the autonomous and deregulated status of private HEIs listed in the memorandum until May 31, 2023.

Higher education enrollments and the number of graduates have steadily increased since the mid-2000s. Public HEIs enroll roughly 46 percent of students. Higher education enrollments grew steadily from 2.7 million in AY 2009-10 to 4.1 million in AY 2015-16, with declines in enrollment in subsequent academic years (AY 2016-17 and AY 2017-18) primarily because there were no new high school graduates in those two years as a result of an extension of the 10-year basic education to 12 years, as shown in Figure 1 (CHED 2020a). Female students slightly outnumber male peers in the higher education sector, comprising 55 percent of all enrolled students (AY 2019-20).

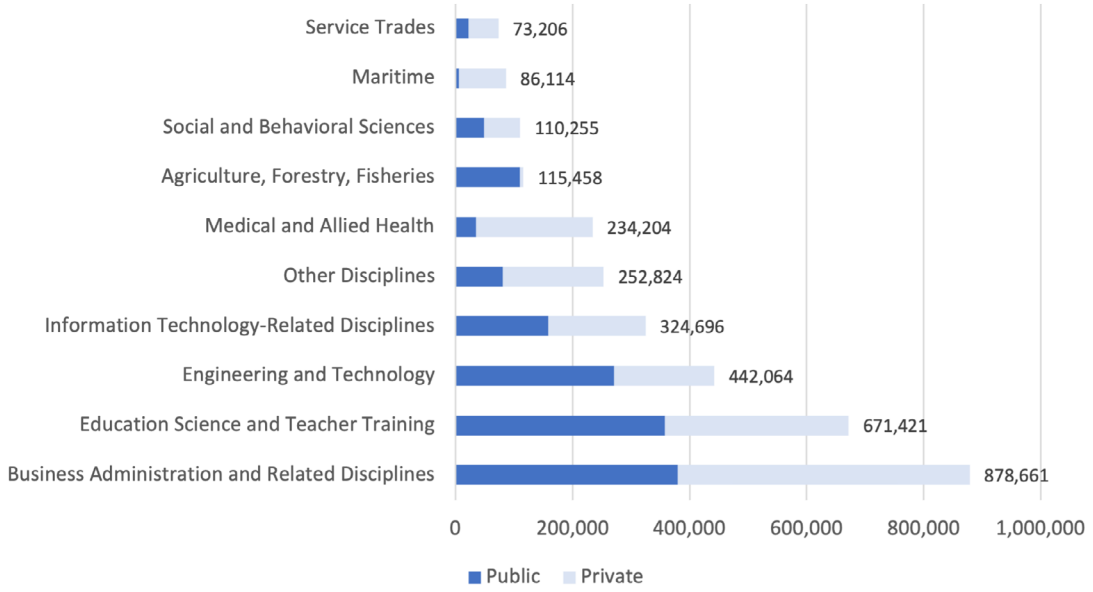
Figure 1. Higher Education Enrollment, AY 2009-10 to 2019-20



Source: Latest available higher educational statistical data, CHED 2020a.
Note: CHED does not break down enrollment by degree and non-degree programs, but only does so by level, such as pre-baccalaureate, baccalaureate, and master's. However, the recent survey with HEIs conducted as part of the development of this report found that less than 25 percent of HEIs offer non-degree short courses, so enrollment here is most likely for degree programs.

Across disciplines, business administration and related fields has had both the largest enrollment and number of graduates since 2010. Education science and teacher training were the next largest disciplines in AY 2019-20. Figure 2 shows the disciplines with the highest enrollment (CHED 2020a).

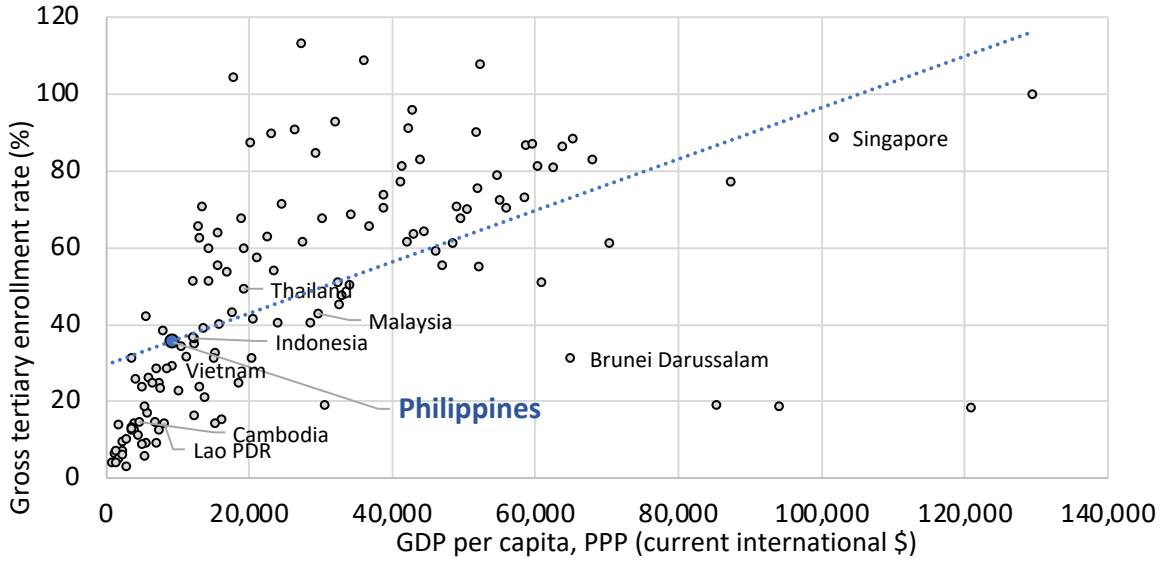
Figure 2. Enrollment in Most Populated Discipline Groups in Higher Education, AY 2019-20



Source: CHED 2020a.
Note: Statistics for public higher education institutions include SUCs, LUCs, and OGSs.

The rapid expansion of the higher education system has led to an increase in higher education participation rate. The gross tertiary enrollment rose from 27.5 percent in 2005 (World Bank 2021a) to 33 percent in 2019 (PNA 2019).[2] The Philippines' participation rate in tertiary education is around what is expected for its level of economic development (Figure 3). The participation rate is more than double that of the Lao People's Democratic Republic and Cambodia, but lower than the rate of Malaysia, Thailand, and Singapore. In terms of the educational attainment of the broader population, approximately 15.1 percent of individuals aged 15 years and older completed at least a college degree.[3]

Figure 3. Comparison of Gross Tertiary Enrollment and GDP per Capita



Sources: World Bank 2020f; 2021a, Philippine News Agency 2019.
Note: Figures show the latest available data for each country from 2016 onwards. Latest enrollment data for the Philippines are from 2019.

[2] https://www.pna.gov.ph/articles/1071884.

[3] Based on World Bank's own calculations from the April 2020 round of the Labor Force Survey of the Philippine Statistics Authority.

1.1.2. The Role of CHED

Through Republic Act (RA) No. 7722,[4] also known as the Higher Education Act of 1994, CHED is tasked with regulating and developing higher education in the Philippines.[5] CHED's functions are regulatory and do not include administration or management of HEIs. Its main regulatory functions revolve around the following responsibilities: First, CHED is tasked with the formulation of policies, standards, and guidelines (PSGs) for the various disciplines and courses of study in all HEIs. In fulfilling this role, CHED seeks assistance from 16 technical panels and 95 technical committees composed of experts in their fields. Most recently, CHED has developed the *CHED Strategic Plan 2022-2028*, which sets the vision, mission, strategic goals, and objectives and actions for the higher education sector (CHED 2022a). Second, CHED is tasked with monitoring the compliance of HEIs with the PSGs. For this function, the tasks are also partially devolved: CHED Central Office monitors programs in medicine, maritime, Expanded Tertiary Education Equivalency and Accreditation (ETEEAP), open and distance learning (ODL), and transnational education (TNE); while CHED Regional Offices (CHEDROs) monitor both undergraduate and graduate programs. CHED also partners with the Professional Regulation Commission (PRC) to monitor disciplines for which professional board examinations are required for practitioners. Third, CHED has the sole authority to grant government authorization to HEIs so that they can operate or offer degree programs in the Philippines. CHED issues certificates of program compliance (COPC) to state universities and colleges (SUCs) and local universities and colleges (LUCs), while it grants permits to private institutions. CHED also issues institutional recognition to LUCs. This function is partially devolved: the CHED Central Office issues the authorizing documents for key programs, such as graduate programs, medicine, nursing, dentistry, maritime, programs without PSGs, ETEEAP, ODL, Ladderized Education Program (LEP), and TNE; whereas the CHEDROs issue the authorizing documents for all undergraduate programs. Fourth, CHED is mandated to monitor and evaluate the performance of HEIs and their programs, including sanctioning HEIs that operate without appropriate permits or recognition, or phasing out programs that do not comply with PSGs or exhibit poor performance in professional examinations. Poor performance means a passing rate of 5 percent or less in licensure examinations in the past three years.

1.1.3. Public Funding

The Philippine government is a major financier of the higher education sector of the Philippines. Government budgets for higher education reached an all-time high in 2019 at ₱146 billion, due mainly to the passage of Republic Act 10931, also known as the Universal Access to Quality Tertiary Education (UAQTE) Act, which made public tertiary education tuition free. Of the ₱146 billion, about half (51 percent) went to CHED, which manages and allocates free tuitions to SUCs, while the other half (49 percent) went to SUCs. As a result of the UAQTE Act, the CHED budget has increased tenfold over the past five years, as shown in Figure 4. However, in 2019 and 2020, the bulk of CHED's budget—about 83 percent—was earmarked for the implementation of the UAQTE with very minimal investment in infrastructure or equipment, i.e., capital outlay (CO). After its major budget increase in 2018, CHED's utilization rate decreased significantly in 2018 and 2019. This implies delayed payments to both institutions and individuals, as well as non-utilization of resources that were intended for specific programs and projects. In 2020, it increased by almost 30 percent. As reflected in the Department of Budget and Management (DBM)'s *Bayanihan* 2[6] budget utilization report,

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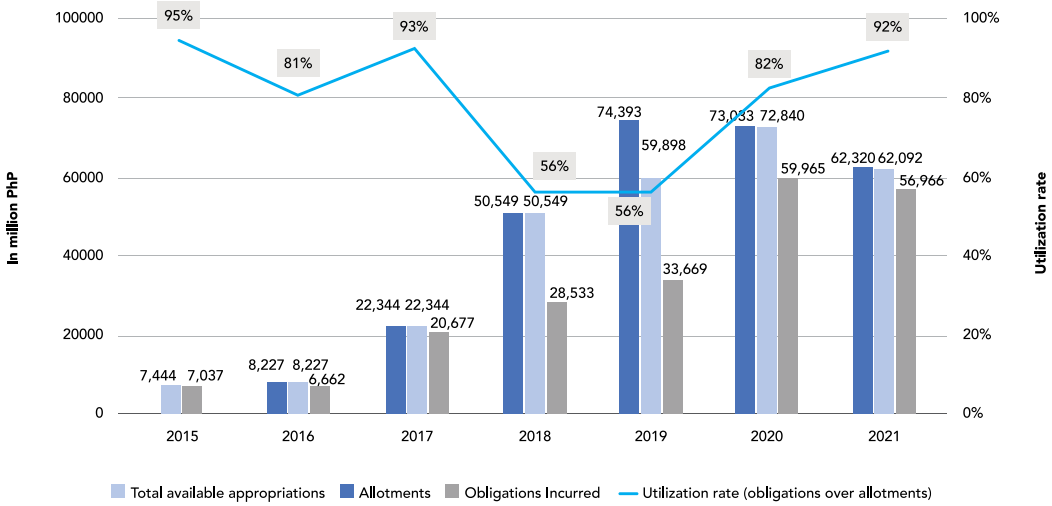
4 https://ched.gov.ph/wp-content/uploads/2017/05/Republic-Act-7722.pdf.

5 The management of education in the Philippines is within the purview of three governing bodies: Department of Education (DepEd) for basic education (K-12), Technical Education and Skills Development Authority (TESDA) for technical-vocational and middle-level education, and Commission on Higher Education (CHED) for higher education.

6 Republic Act No. 11494 or the Bayanihan to Recover as One Act, also called Bayanihan 2. In one report, CHED suggested that the extended deadline for the use of Bayanihan 2 funds until June 30, 2021 could be the reason that the 2020 COVID-19 funds were initially reported as underutilized (Sarao 2021).

CHED fully disbursed ₱1 billion allotment for the UAQTE as of December 2021 (DBM 2021). In addition, by July 2021, CHED reported a 99 percent utilization rate of these funds for student subsidy and Smart Campus development during the pandemic (CHED 2021b). Data also show that CHED utilized a little more than 90 percent of its total budget in 2021.

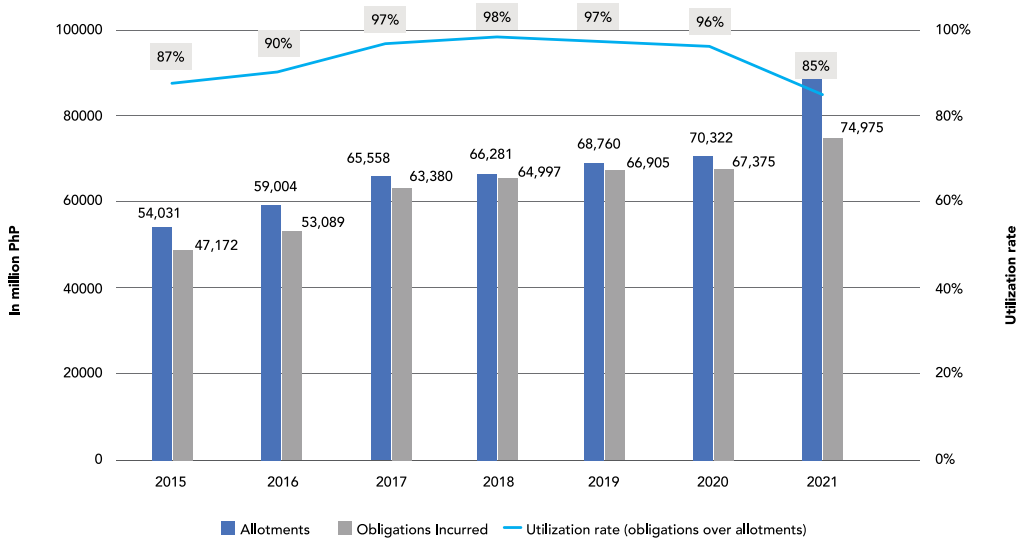
Figure 4. CHED Appropriations, Allotments, and Obligations Incurred, 2021 (million, ₱)



Source: DBM 2022.

The budget increases for SUCs have been more modest, but their income portfolio has changed significantly. In the past, almost a third of SUC funding came from internally generated income, i.e., tuition and other fees charged to students, income from auxiliary services such as dormitories, and other income-generating projects; while the remainder came from subsidies provided by the national government (Manasan & Revilla 2015). However, with the passage of the UAQTE Act, SUCs no longer need to collect tuition fees from students. SUCs have been able to utilize majority of their funding from the national government, posting budget utilization rates of at least 90 percent between 2016 and 2020, as shown in Figure 5.

Figure 5. SUC Budget and Expenditures (million, ₱)



Source: DBM 2022.

Local universities and colleges are financed by local government units (LGUs) and operate independently from CHED, but recent policy reforms such as the UAQTE Act have incentivized LUCs to adopt the standards issued by CHED. Prior to the reforms, CHED released PSGs (CHED 2006) to define the minimum standards for LUCs. However, it was only with the passage of the UAQTE Act in 2019 did the LUCs change the way they conducted their business, as tuition and other school fees are mandated to be free in these institutions but only if they are compliant with CHED standards. In 2019, CHED identified 78 LUCs (about 70 percent of all LUCs) to receive central government budget to cover tuitions after they were given either a Recognition of Institution or a Certificate of Program Compliance by CHED (Ortiz et al. 2019).

The government does not directly finance private HEIs but helps through student funding. By virtue of Republic Act No. 8545, also known as the Expanded Government Assistance to Students and Teachers in Private Education Act, the government provides incentives, scholarships, grants, and loans for students in private HEIs. In 2020, over ₱1 billion was appropriated for this purpose through the Private Education Student Financial Assistance Program. Additionally, the UAQTE Act covers programs for students in private HEIs: the Tertiary Education Subsidy (TES) provides grantees enrolled in private HEIs a maximum of ₱60,000 per academic year, while the Student Loan Program for Tertiary Education Short-Term (SLPTE-ST) provides a maximum loan of ₱60,000 per academic year with no interest charged within the loan term, to cover students' expenses. In early 2021, in response to the COVID-19 pandemic, CHED released close to ₱300 million to 927 private HEIs to reduce the unpaid tuition and miscellaneous fees of their students. This benefited over 54,000 students in private HEIs.

During the height of the COVID-19 crisis in 2020, CHED financed three major digital transformation initiatives to provide resources at no cost to teachers and students and improve the access and quality of remote learning. These initiatives, which are intended to ensure learning continuity during the pandemic, are as follows: i) PHL CHED Connect, ii) CHED HiEd Bayanihan, and iii) Smart Campus Project. PHL CHED Connect is an open educational resources platform (OER) for teachers and students that provides free learning, teaching, and research materials. CHED partnered with Globe Telecom—a major provider of telecommunications services in the country—to offer free data access to PHL CHED Connect to teachers and students who are also Globe customers. CHED HiED Bayanihan[7] is a free, digital community for capacity building on flexible learning and resource sharing among HEIs in the country. It is a platform for sharing resources and best practices in higher education. The Smart Campus Project grants public funds to eligible public HEIs under Section 10(i) of the Bayanihan to Recover Act (RA 11494)[8] to optimize their capabilities to provide digitalized services as necessitated by mobility restrictions during the pandemic. Details of the three initiatives are discussed in Section 2.2.5.

1.1.4. Quality Assurance

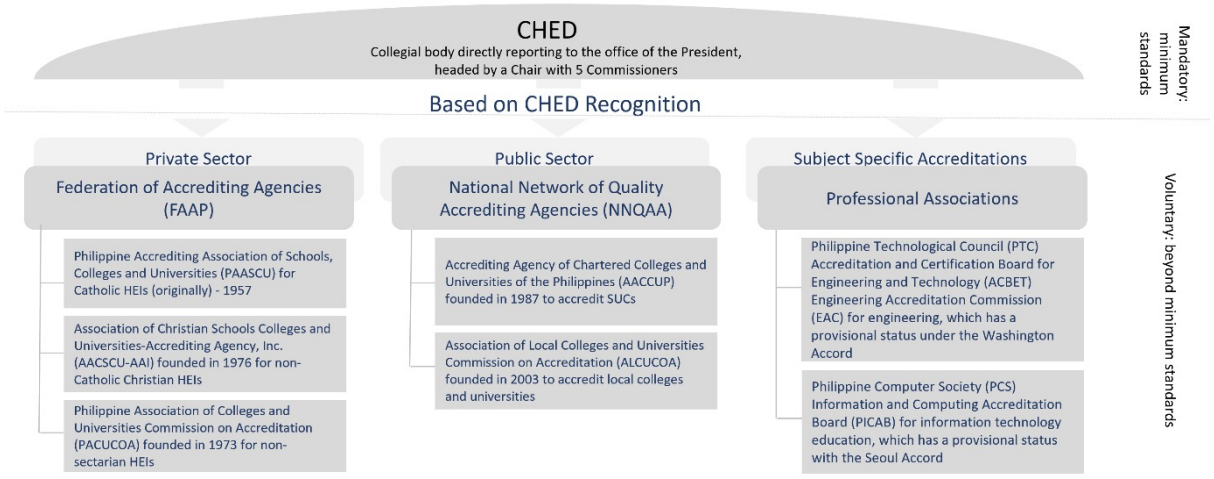
CHED plays a regulatory and developmental function in external quality assurance (EQA) for higher education in accordance with the ASEAN regional quality assurance framework. CHED's Office of Institutional Quality Assurance and Governance and Office of Programs and Standards Development are responsible for quality assurance of HEIs. Their functions include assisting and monitoring the quality management and governance initiatives of HEIs, formulating and supporting the implementation of institutional policies and guidelines on quality assurance and governance and advocating sustained promotion for continuing quality improvement as well as transparent and responsible institutional governance. CHED is part of the ASEAN Quality Assurance Network (AQAN), whose AQAN Framework for Higher Education is used by ASEAN member countries to benchmark and align their quality assurance (QA) systems (ASEAN 2019). CHED also met the ASEAN Qualifications Reference Framework (AQRF) referencing criteria.

7 https://ched.gov.ph/universities-colleges-gear-up-for-opening-of-classes-in-august/.

8 https://www.officialgazette.gov.ph/downloads/2020/09sep/20200911-RA-11494-RRD.pdf.

CHED established a complex hierarchical EQA system where HEIs voluntarily submit to an institutional or program accreditation by any of the recognized accreditation agencies and using the agencies' standards and processes. As shown in Figure 6, CHED (2005) certified two umbrella networks that are mandated to recognize external quality assurance bodies: the National Network of Quality Assurance Agencies (NNQAA) for the public sector and the Federation of Accrediting Agencies of the Philippines (FAAP) for the private sector. To date, for the public sector, NNQAA has recognized two non-government QA agencies: the Accrediting Agency of Chartered Colleges and Universities in the Philippines (AACCUP), established in 1987; and the Association of Local Colleges and Universities Commission on Accreditation (ALCUCOA), established in 2003 (QAA 2018). For the private sector, FAAP has recognized three non-government QA agencies: the Philippine Accrediting Association of Schools, Colleges, and Universities (PAASCU), established in 1957 mainly for private Catholic institutions; the Philippine Association of Colleges and Universities Commission on Accreditation (PACUCOA), established in 1973 for private non-sectarian institutions; and the Association of Christian Schools, Colleges, and Universities - Accrediting Council, Inc. (ACSCU-ACI, formerly ACSCU-AAI or Association of Christian Schools, Colleges and Universities - Accrediting Agency, Inc.), established in 1976 for Christian institutions. In addition, there are subject-specific accreditations by professional associations. Each accrediting agency has its own standards and processes based on general policies and guidelines issued by CHED, and all accreditation processes are required to have a self-evaluation prepared by the HEI (as discussed in the following section) and an on-site evaluation by peers. CHED also has its own EQA system which is voluntary in nature. This is the designation to be a Center of Excellence (COE) or Center of Development (COD). Evaluation criteria are above the minimum standards and evaluation by technical experts not organic to CHED conduct the evaluation.

Figure 6. Philippine External Quality Assurance Mechanism



Source: World Bank 2021b. *A Rapid Review: Digital Transformation of Higher Education in the Philippines.* Unpublished.

In the Philippines, institutional quality is assured primarily through an institutional self-evaluation, followed by a CHED assessment. CHED introduced the Institutional Sustainability Assessment (ISA) framework, which includes an ISA Self-Evaluation Document (SED) that HEIs use to assess their institutional sustainability in five key result areas: (i) Governance and management; (ii) Quality of teaching and learning; (iii) Quality of professional exposure, research, and creative work; (iv) Support for students; and (v) Relations with the community. Within each key result area there are several core indicators that apply to all HEIs, as well as other indicators that apply depending on their relevance to the mission and stage of development of the HEI (CHED 2017c). One of the core indicators for the quality of teaching and learning includes the use of ICT to enhance student learning and performance.

The ISA framework helps HEIs establish an internal quality assurance system for assessing their internal capacity to translate vision, policy, and strategy into quality programs and quality results. The ISA results are used by HEIs in their application for autonomous or deregulated status. The category assignment is based on two criteria: (i) commitment to excellence, as evidenced, for instance, by the presence of centers of excellence (COEs) or centers of development (CODs) or achieving Levels III or IV accreditation status for a set number of programs; and (ii) institutional sustainability and enhancement, as evidenced, for instance, by the HEI's ISA scores.[9] Private HEIs that are granted autonomous and deregulated status are entitled to several benefits, including exemption from regular monitoring and evaluation by CHED.[10] Autonomous and deregulated HEIs are also given priority in the grant of subsidies and other financial incentives or assistance from CHED. They also have the authority to grant an honorary degree to qualified individuals. In addition to these benefits, autonomous HEIs can launch new programs in the undergraduate or graduate levels without securing a permit or authorization from CHED, offer extension classes, establish linkages with foreign HEIs, offer programs via alternative modes such as distance education, and increase tuition fees without securing a permit from CHED (CHED 2016).

In terms of the accreditation status issued by non-government accrediting agencies, program accreditation levels begin with a candidate status, which is assigned to programs that demonstrate potential for acquiring accredited status within two years, followed by Levels I to IV. In AY 2018-19, only 7,909 (19 percent) of 41,536 programs achieved at least a Level I accreditation status and only 701 HEIs (29 percent of all HEIs) had at least one accredited program. Note that two professional accrediting agencies—the Philippine Technological Council through its Accreditation and Certification Board for Engineering and Technology and the Philippine Computer Society Information and Computing Accreditation Board—do not follow this leveling, but have their own categories based on international standards such as the Accreditation Board for Engineering and Technology (ABET), the Washington Accord (engineering programs), and the Seoul Accord (computing and IT-related disciplines). Either way, because program accreditation remains voluntary, only a small number—less than 20 percent of HEI programs—have been accredited. Institutional accreditation done by non-government accrediting agencies is anchored on program accreditation: a key eligibility criterion for institutional accreditation is that at least 75 percent of programs within the HEI must be accredited, including Level I accreditation status. Moreover, most of the total student population must be enrolled in the accredited programs, and the performance of their graduates in licensure examinations must be at par with or above the national passing rate for at least five consecutive board examinations (PACUCOA 2022). As of September 2022, only a limited number of public and private HEIs hold institutional accreditation from the non-government accrediting agencies recognized by CHED (AACUP 2022; ALCUCOA 2022; PAASCU 2022; PACUCOA 2022a).

1.2. Sectoral Context for Digital Transformation

This section reviews the sectoral context of pursuing digital transformation in higher education. First, it reviews the existing digital infrastructure, focusing on internet connectivity and the use of ICT in HEIs. Second, it reviews a number of initiatives to support the digital transformation of the higher education sector. Lastly, it presents an analysis of the digital maturity and readiness of sample public HEIs based on an online survey.

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[9] COEs are departments within HEIs that demonstrate excellent performance in instruction, research, extension, and linkages. CODs are departments within HEIs that demonstrate the potential to become COEs.

[10] It is noteworthy that these benefits are mostly for private HEIs because the charters of public HEIs already provide the benefits by default. However, public HEIs may still opt to undergo accreditation as accreditation levels are used by CHED and DBM in recommending budgetary allocations to public HEIs. Additionally, as with the benefit for accredited private HEIs, accredited public HEIs are entitled to priority in terms of funding assistance from CHED for scholarships and faculty development, facilities improvement, and other development programs, as well as the right to use the word *accredited* in their publications or advertisements (CHED 2005).

1.2.1. Digital Infrastructure and the Use of ICT

1.2.1.1. Internet Connectivity

Digital transformation in the Philippine higher education sector began prior to the pandemic, but its progress has been slow due to multiple and interrelated constraints. One major constraint is limited access of students to digital infrastructure, particularly among low-income students. The National ICT Household Survey 2019 found that 82 percent of respondents do not have access to the internet and 76 percent do not have access to a computer at home. Many of them cited the high cost of internet accounts (33 percent) and the high cost of equipment (21 percent) as reasons for not having access. Most of them (79 percent) reported using a cellphone over the last three months, but only 30 percent reported using a computer over the same period. In terms of internet use by type of activity, only 6 percent of individuals reported using the internet for learning, while a substantial number (43 percent) reported using the internet for social activities. To access computers, almost a third of the respondents reported using computer shops. Even though more than one-fifth of barangays offer free Wi-Fi, only about 1 percent of students access free-use barangay or community computers (DICT 2019c). Hence, for many higher education students in the Philippines, losing physical access to the campus infrastructure often meant loss of digital infrastructure. The move to flexible learning left millions of students without digital access and with only offline learning options.

1.2.1.2. Digital Skills among HEI Administrators and Faculty

Besides limited digital infrastructure, the lack of digital skills and pedagogical knowledge among the faculty has constrained digital transformation: to date, HEIs tend to use ICT the most for administrative tasks and less for teaching and learning. A survey conducted with 95 Philippine HEIs in 2012 found that teaching and learning with technology was rated to be of high strategic priority for HEIs, but digitalization plans were not fully executed in many HEIs due to barriers such as limited digital skills among the faculty and weak ICT infrastructure (Marcial 2012a).[11] The survey found that no more than half of HEIs had information systems for e-learning or curriculum delivery, information and publication systems, appraisal and evaluation systems, and management reporting systems. Another survey on information technology resources conducted with 97 Philippine HEIs found that information systems in higher education appeared to be most utilized for administrative processes (Marcial 2012b).[12] The most frequently cited information systems present in HEIs were those for enrollment, grading, accounting, and payroll systems, with more than 80 percent of HEIs reporting their use. In a study conducted with faculty members of the University of the Philippines Open University (UPOU), lack of knowledge and training on appropriate pedagogy for online learning was cited as the main challenge in delivering distance education (Arinto 2016). Similarly, in a study of faculty members' readiness for technologically enhanced teaching in teacher education institutions, most educators reported having little exposure to learning management systems and digital enablers such as augmented and virtual reality. They also had not extensively used online or blended learning (Rivika, Boholano, & Dayagbil 2020).

The rapid shift to distance learning due to the ongoing COVID-19 pandemic exposed the bottlenecks in digital transformation and highlighted the urgent need to adopt digital technologies that can enhance teaching and learning. In a study of perceptions on online education during the COVID-19 pandemic (Moralista & Oducado 2020), the faculty in a SUC cited several challenges in online education such

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[11] Marcial, Dave E. 2012a. Teaching and learning with technology in higher education institutions in the Philippines. *PeLS Online Journal* 3, no. 1: 50-6.

[12] Marcial, D.E. 2012b. "Information technology resources in the higher education institutions in the Philippines." *Philippine Information Technology Journal* 5, no. 1: 3-7. Moralista, Rome B., and Ryan Michael F. Oducado. 2020. "Faculty Perception toward Online Education in a State College in the Philippines during the Coronavirus Disease 19 (COVID-19) Pandemic." *Universal Journal of Educational Research* 8, no. 10: 4736-4742. doi:10.13189/ujer.2020.081044.

as changes in class dynamics through lower student-teacher interaction, a high degree of depersonalization among students and teachers, more instances of academic dishonesty, less engaging student discussions, and most importantly, less learning for students. Similarly, less than half of the students in a study in a Philippine HEI (Baticulon et al. 2021) responded that their teachers have the necessary resources and skills to teach online and that their HEI has the infrastructure and resources for online teaching. These findings highlight that the digital transformation of learning and teaching will not be effective without strengthening the ICT infrastructure and teacher training on the use of these technologies. The findings are consistent with the results from a recent World Bank (2021c) online survey with HEIs, as well as focus group discussions (FGDs) with faculty and students, regarding digitally enhanced learning and teaching. The survey and FGDs suggest that while majority of HEIs report having institutional strategies in place, limitations in digital infrastructure, access to digital devices, and professional development hinder the use of digitally enhanced learning and teaching in Philippine HEIs.

1.2.1.3. Philippine Research, Education, and Government Information Network

The Philippine Research, Education, and Government Information Network (PREGINET) is the Philippines' research and education network that provides a secure, high bandwidth, specialized internet service to HEIs, government, and research institutions, but only a small number of education institutions can access it. More specifically, PREGINET provides: (i) direct connectivity within local HEIs; (ii) direct connectivity to international research and education networks (RENs), including the Asia-Pacific Advanced Network (APAN), Asian Internet Interconnection Initiatives, and Trans-Eurasia Information Network 3; (iii) value-added services that enhance communications such as multicast, video on demand, videoconferencing, and Voice over Internet Protocol (VoIP); (iv) Internet Protocol version 6 (IPV6) services; and (v) eduroam services.[13] It also (vi) provides institutions with server co-location at PREGINET facilities; and (vii) facilitates the formation of user communities in agriculture, bioinformatics, disaster mitigation, distance education, advanced network technologies, and telemedicine.[14] PREGINET's partners can use the platform to pursue collaborative research and initiatives with leading universities and research institutions abroad. However, to date, PREGINET works more with partner research institutions than with HEIs, except for the top three research-oriented HEIs, namely, Ateneo de Manila University, University of the Philippines, and De La Salle University, and one secondary school, the Philippine Science High School – Main Campus. Moreover, CHED is not listed as a PREGINET government partner.[15] There is the Philippine Higher Education Network, a research group of 10 SUCs and private HEIs, and there are 18 Higher Education Regional Research Centers, but they do not have physical connectivity and are currently inactive.

PREGINET recently contributed to COVID-19 response initiatives, but how it can support higher education's digital transformation is yet to be explored. In 2020, through the help of the Advanced Science and Technology Institute of the Department of Science and Technology (DOST-ASTI), the connectivity of the Department of Health (DOH) to PREGINET was upgraded, doubling its network capacity to support DOH's activities such as research, telemedicine, data transfers, and the use of multiple network-based communication platforms (UNCTAD 2020). PREGINET has continued to support telemedicine initiatives, working closely with the Telemedicine Network of the Philippines. Through PREGINET's high-speed research network, DOH patients can consult remotely with doctors and healthcare professionals can attend real-time virtual conferences and webinars (Reyes-Lamando 2020). PREGINET has also helped advance agricultural genomics and enabled connections with the global rice community by supporting the International Rice Research Institute (IRRI) in the 3K Rice Genome Project.

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13 eduroam (*education roaming*) is an international Wi-Fi internet access roaming service for users in research, higher education and further education. It provides researchers, teachers, and students network access when visiting an institution other than their own (https://eduroam.org/eduroam-reaching-out-to-asia/).

14 http://pregi.net/.

15 PREGINET lists the Office of the President, to which CHED is attached, as a partner. However, it is unclear to what extent PREGINET collaborates with CHED.

PREGINET could further contribute to the digital transformation of the higher education sector by expanding its portfolio of services. The establishment of new platforms that provide generic services to HEIs and research institutes will help advance the collaboration. Such services include: (i) authentication and authorization infrastructure—a service that enables members of different institutions to access protected information; (ii) high performance computing—an essential service that enables specific types of research to take place without every HEI making significant investments on the infrastructure for computational analyses; (iii) collective access to international digital research databases; and (iv) local collective research database.

1.2.1.4. Learning Management Systems

The majority of HEIs use learning management systems (LMS), but their use is limited, especially among public HEIs. A survey of HEIs showed that in the Philippines, 87 percent of private HEIs and 67 percent of public HEIs use LMS, with Blackboard and Canvas as the most prevalent platforms (World Bank 2021d). Furthermore, 88 percent of private HEIs and 72 percent of public HEIs access open libraries, research databases, and e-journals; and 50 percent of all HEIs have online repositories for educational materials. An LMS can provide the means to deliver massive open online courses (MOOCs), which are increasingly used among students in the Philippines to supplement their on-campus curriculum. MOOCs are courses either developed by the university or obtained from global online course providers. They are usually self-paced, not instructor-led, and can lead to a digital certificate. Data from a survey of 3,381 students conducted by the World Bank in 2022 revealed that one out of four students use MOOC courses and micro-credentials to benefit from globally curated content and certifications offered by the world's top universities (Garcia & Imaizumi 2022). (See Box 2 on courses taken by Filipino students on MOOC online platforms).

Teaching support tools and classroom tools are very important in transforming the learning experience of students. Instructors can share their notes real time and students can collaborate on documents inside or outside the classroom. Moreover, a set of hardware and software can be used to provide probes inside the classroom (or LMS) lectures and give the instructor the capability to adjust to the students' level of understanding of topics and ensuring that students are confident about their level of knowledge on a specific topic before moving to the next one. The survey of HEIs showed that a high proportion (83 percent) of the institutions support teachers in digital learning by giving them dedicated units and centers, licenses for video conferencing software (73 percent), and an online platform. More than half of HEIs cited that peer exchange within the institution enables the teaching staff to help each other, while 47 percent view exchange and collaboration organized by senior officials of the HEIs as useful measures. Likewise, collaboration with other HEIs, use of self-evaluation tools, and diagnostics to better understand strengths and weaknesses, were cited as key measures for improving teaching. However, only 51 percent of HEI respondents were provided with incentives and funding for teachers to engage in online teaching (World Bank 2021c).

Box 2: Courses Taken by Filipino Students on MOOC Online Platforms

Coursera is the most widely used online course provider in the Philippines, with majority of students having taken courses mostly in technology, data science and project management, including information technology (IT) certification courses developed by Google such as cloud computing, data analytics, and user experience (UX) design. In non-technical fields, the most in-demand Coursera courses were "Learning How To Learn" and languages, e.g., Korean, Mandarin/Chinese and/or Japanese. Users of EdX enrolled mostly in science-related courses such as biochemistry, anatomy, pharmacology, and IT/computer science courses. In the Udemy learning platform, majority of students enrolled in courses in programming and web development. Table 2 lists the most preferred courses that are aligned with skills and competencies considered critical in digital transformation and in meeting the demands of the 4th Industrial Revolution (Coursera 2021).

Table 2. Filipino Students Take MOOCs to Fill Curriculum Gaps

BUSINESS	TECHNOLOGY	DATA SCIENCE
Project management	Security engineering (cybersecurity)	Data science – foundational courses
Business analytics	Operating systems (C programming language, JavaScript, IT certification courses - Google)	Artificial intelligence
Accounting	Nanotechnology and nanosensors	Machine learning
Digital marketing	Human computer interaction (user interface/user experience design (UI/UX), graphics design	Statistical programming – R, Python
Communication, business writing	Software engineering (web development, game development, software development)	Big data and data analytics

Source: World Bank 2022a

1.2.2. Digital Transformation Initiatives

1.2.2.1. Guidelines on Flexible Learning

In September 2020, CHED released the guidelines on the implementation of flexible learning and teaching for all HEIs.[16] As previously mentioned, CHED's ISA framework already includes criteria related to the use of ICT in key results areas: for instance, in evaluating the quality of learning and teaching, a core indicator is the use of ICT to enhance student learning and performance. With the new guidelines on the implementation of flexible learning and teaching, HEIs are required to provide students with flexible learning options, including, but not solely focused on the use of technology. HEIs are also asked to develop learning continuity plans containing their framework and a system for transitioning and integrating flexible learning approaches. In response to these guidelines, HEIs around the country adopted various forms of remote learning to suit the needs of students and teachers.

In March 2021, CHED gradually began to authorize select disciplines to offer in-person classes. In March 2021, CHED granted 24 HEIs permission to convene in-person classes on a limited basis in select disciplines, namely, medicine, nursing, medical technology, medical laboratory science, physical therapy, midwifery, and public health.[17] In October 2021, marine transportation and marine engineering were added to the list.[18] Another memorandum was issued in December 2021 allowing the phased reopening of limited face-to-face classes in all HEIs under Alert Levels 1, 2, and 3. By March 2022, the Inter-Agency Task Force for the Management of Emerging Infectious Diseases authorized HEIs under Alert Level 1 to offer face-to-face classes in full seating capacity for fully vaccinated teachers and students.[19] CHED maintains its flexible learning policy to allow unvaccinated and partially vaccinated students to continue their studies.[20]

A group of volunteers from several HEIs developed guidelines on data privacy and online learning. In June 2020, data protection officers from several HEIs volunteered to create guidelines on data privacy specific to online learning after schools experienced data breaches upon shifting to online learning

[16] CHED Memorandum Order No. 4, Series of 2020. https://ched.gov.ph/wp-content/uploads/CMO-No.-4-s.-2020-Guidelines-on-the-Implementation-of-Flexible-Learning.pdf.

[17] CHED-DOH Joint Memorandum Circular No. 2021-001.

[18] CHED Memorandum Order No. 20, Series of 2021.

[19] CHED-DOH Joint Memorandum Circular No. 2021-004.

[20] Philippine News Agency 2022. "Classroom mix in Alert Level 1 areas depends on schools: CHED," dated March 12, 2022. https://www.pna.gov.ph/articles/1169629; Inquirer.net. 2022. "College classes back to full capacity in 'level 1' areas," dated March 12, 2022. https://newsinfo.inquirer.net/1567041/college-classes-back-to-full-capacity-in-level-1-areas.

platforms during the COVID-19 pandemic. These HEIs include the University of the Philippines-Diliman, University of the Philippines-Manila, University of the Philippines-Cebu, Ateneo de Manila University, De La Salle University, San Beda University, and Technological University of the Philippines. The guidelines were contained in a document entitled Data Privacy Council Education Sector Advisory (No. 2020-1): Data Privacy and Online Learning. It listed guidelines on the use of learning management systems (LMS), online productivity platforms (OPP), social media, webcams, and other recording devices used for online learning. The guidelines include: (i) restrictions in viewing personal data such as grades and other academic results; (ii) restrictions in downloading personal data stored in the LMS or OPP; (iii) discouraging submissions through social media; (iv) ensuring that personal data posted on social media are done for legitimate purposes and using official school accounts; (v) ensuring that parents, guardians, and students consent to online recording, such as during proctoring (NPC 2021).

1.2.2.2. Open Distance e-Learning Programs

The Open Distance Learning Act of 2014 (RA 10650)—which institutionalized open distance learning (ODL) in tertiary education to expand access to quality education—is currently the only national policy that provides the legal basis and minimum guidelines for ODL programs (Joaquin, Biana, & Dacela 2020). RA 10650 covers public and private HEIs and post-secondary schools offering ODL programs, as well as other institutions aiming to become qualified implementers of ODL programs. It requires ODL programs to be: (i) learner-centered, with the goal of facilitating independent learning; (ii) of quality and relevance, such that they are at par with traditional classroom programs; (iii) transparent in terms of curriculum and other relevant information, which must be made available online or through other means to students, peers, regulators, and accrediting bodies; (iv) subject to peer reviews organized by CHED or TESDA; (v) responsible and accountable to the public and their stakeholders, especially learners, in terms of consumer protection; and (vi) self-monitoring for quality and continuous improvement, including establishing a needs assessment framework for students, faculty, technology, and other resources.

RA 10650 identifies CHED as the regulator for HEIs and TESDA for post-secondary schools offering ODL programs. CHED and TESDA are responsible for: (i) setting policies, standards, guidelines, rules and regulations for effectively implementing ODL in the country; (ii) developing quality improvement systems and strategies; (iii) monitoring and evaluating ODL programs for continuation or closure in accordance with the provisions of the Higher Education Act of 1994 (RA 7722), Manual of Regulations for Private Higher Education, and other issuances of CHED and TESDA; (iv) approving or disapproving new ODL program proposals; and (v) recommending ODL budgets for qualified SUCs and post-secondary schools based on their respective monitoring and evaluation results. HEIs administering ODL are allowed to determine the program, curriculum, course offerings, and learning monitoring mechanisms for ODL. They are also given flexibility in using various modes of delivery such as print, audio-visual materials, virtual classrooms, and face-to-face sessions in learning centers, provided that they meet the minimum requirements defined in Section 8 of RA 10650, which include practicum requirements and licensure examinations for certain courses.[21] In 2016, CHED released policies, standards, and guidelines for transnational education programs, including ODL.[22] Furthermore, CHED and TESDA each released guidelines on the implementation of flexible learning modes, which also cover ODL.[23]

The University of the Philippines Open University (UPOU) leads open and distance e-learning (ODeL) in the Philippines, which combines the philosophy of open learning, pedagogies of distance education, and technologies of e-learning. ODeL means that: (i) students and teachers are separated by space and

[21] IRR on the Open Distance Learning Act. 2016. https://www.aide.edu.ph/wp-content/uploads/2019/10/IRR-R.A.10650-ONAR.pdf.

[22] CHED Memorandum Order No. 62, Series of 2016.

[23] CHED Memorandum Order No. 4, Series of 2020; TESDA Circular No. 62, Series of 2020.

time; (ii) students participate in asynchronous learning and undertake independent study, with learning packages designed and distributed by the faculty in charge; (iii) students and teachers use an open-source LMS; and (iv) final examinations may be conducted online or face-to-face at designated learning and testing centers. UPOU has a network of eight learning centers and 20 testing centers in the Philippines and abroad, which enables it to reach learners in over 70 countries (UPOU n.d.). RA 10650 mandates UPOU to assist CHED and TESDA in setting policies and monitoring and evaluating the implementation of ODL programs, and to assist HEIs and post-secondary schools in developing their own ODL programs.

Two policies were issued in response to the challenges faced by HEIs amid COVID-19. One is a CHED memorandum (CMO No. 4, Series of 2020) containing guidelines on flexible teaching and learning. The other is Senate Bill No. 1459, which was filed in May 2020 to amend RA 10650 and create a Tertiary Online Learning and Distance Education Office within CHED. The office is to be supported not only by CHED but also by the Department of Information, Communications and Technology (DICT) and DOST. It is expected to prescribe minimum guidelines that are of a higher standard to ensure ODL continuity, especially in times of national emergencies, calamities, or health crises. Both the CHED memorandum and the Senate Bill seek to address gaps in ODL policies, standards, and guidelines (Terrazola 2020). As of May 2022, however, the proposed bill is yet to be passed.

1.2.2.3. PHL CHED Connect

In response to the demand for more flexible modes of learning, CHED launched PHL CHED Connect in June 2020. This open educational resources platform for teachers and students provides free access to learning, teaching, and research materials.[24] Data show that as of January 2022, more than half (65 percent) of all users accessed the platform through their mobile devices, which is likely attributed to the free access to the platform given to Globe and TM subscribers as part of a partnership with CHED.[25] Content on the platform comes from local and international contributors. Local contributors include eight private universities and seven national and state universities. Eight international partners, composed of government ministries, research and development organizations, and universities abroad, have also contributed content.[26]

The platform is positively rated and given a five-star rating by 80 percent of users. CHED reports that the users attributed their positive experience to the breadth of resources and the intuitive interface of the platform. As of January 2022, 198,218 users were subscribed to the platform, 97 percent of whom are in the Philippines. The most visited learning content were criminal justice and governance with 2,750 uploaded materials. The top key words searched by users were: i) management, ii) science, iii) education, iv) mathematics, and v) accounting.

1.2.2.4. CHED HiEd Bayanihan

CHED HiEd Bayanihan is an online community where HEIs can collaborate and share knowledge. The general purpose of this community is to assist HEIs to smoothly transition to flexible learning. It is "a virtual and free cooperative learning environment for educational fora, training, capacity building and resource sharing among Philippine HEIs. It is a digital community of educators, learners and content makers that explore innovative responses in the context of Philippine HEIs" (CHED 2020c).[27] The community aims

[24] PHL CHED Connect Assessment Report (January 2022).

[25] CHED partnered with Globe, one of the country's major telecommunications networks, to provide free data access to PHL CHED Connect to Globe and TM mobile subscribers (CHED 2022b).

[26] CHED's international partners for PHL CHED Connect include the British Council; Australian Aid; ASEAN; William Angliss Institute; Ministry of Science, ICT and Future Planning, South Korea; University of Saskatchewan, Canada; University of Cincinnati; and SEAMEO INNOTECH.

[27] CHED 2020c, August 4. CHED HiEd Bayanihan. Accessed April 2022, from Facebook: https://www.facebook.com/CHEDHiEdBayanihan/.

to promote collaboration among HEIs by providing an online venue for sharing best practices and peer mentoring on how to effectively shift to online learning. It also intends to promote research on the shift to off-campus and online teaching and learning modes and encourage monitoring through the community (CHED 2020c). In its first press conference in 2020, speakers from three HEIs shared their planned capacity building programs, which focused on training teachers to transition to hybrid learning during the pandemic (CHED 2020d). In collaboration with CHED, various HEIs have conducted training seminars for HEI faculty members on flexible learning delivery modes. For example, the UPOU offered a two-week training program entitled *Flexible Teaching and Learning: The Seamless Shift from Face-to-face to Distance Education Mode of Instruction* in 2020. This consisted of four modules intended to equip teachers with the knowledge and skills in modes of instruction best suited for the shift to distance education (CHEDRO3 2020).[28]

1.2.2.5. Smart Campus Project

In light of the COVID-19 pandemic, the national government allocated additional funding to support the digital transformation and modernization of education, including the Smart Campus Project for higher education. The Updated Philippine Development Plan 2017-2022 lists both digital transformation and learning continuity as two of five major programs "designed to build the resilience of individuals, families, business, government, and society under the new normal" (NEDA 2021a). Among the strategies to improve the quality of higher education and research is the modernization of learning and teaching methods, including pedagogical approaches to maximize the potential of ICT in delivering flexible learning options. In July 2020, Republic Act No. 11494, also known as the Bayanihan to Recover as One Act, was issued to support COVID-19 response and recovery interventions. Such interventions included the appropriation of ₱3 billion (approximately US$60 million) to assist SUCs in the development of smart campuses through investments in ICT infrastructure as well as acquisition of learning management systems and appropriate equipment to fully implement flexible learning modalities. In allocating these funds, CHED issued Memorandum Order No. 9, Series of 2020, which provided guidelines for SUCs on applying for financial assistance for the development of smart campuses. The guidelines prioritized projects aimed at addressing flexible learning and e-learning through internet connectivity, campus area networks, learning management systems, smart campus development planning, and learners' information systems (CHED 2020e).

1.2.3. Digital Maturity and Readiness of Higher Education Institutions

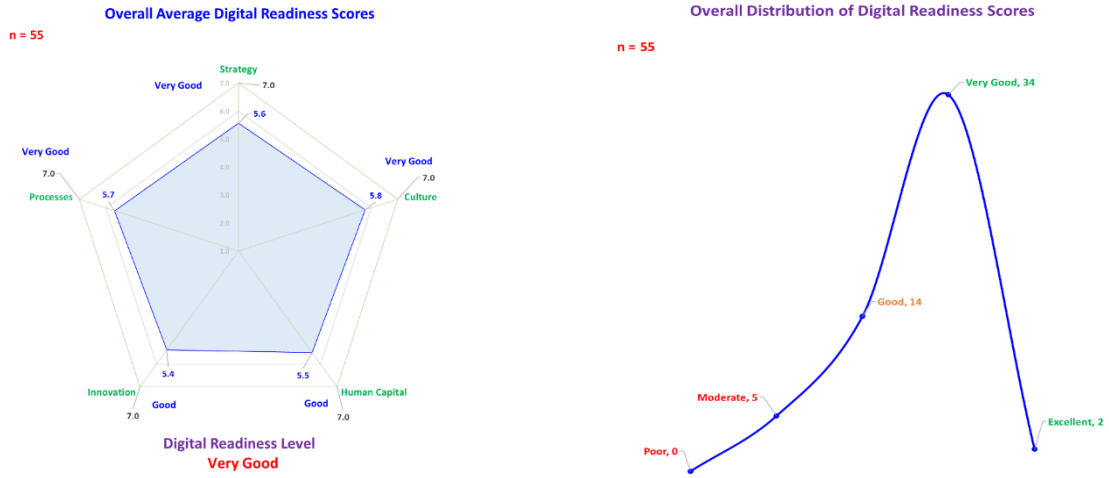
According to the results of two digital transformation surveys of non-representative samples, public HEIs—mostly SUCs—demonstrate a very good level of digital readiness but a moderate level of digital maturity. The World Bank, in collaboration with CHED, conducted the surveys in April and May 2022 and measured the digital readiness and maturity of HEIs in five dimensions: (1) strategy, (2) culture, (3) human capital, (4) processes, and (5) innovation.29 In these surveys, digital readiness is defined as the level of readiness of HEIs to embark on digital transformation, while digital maturity is the level of achievement in the process from digitization through digitalization to digital transformation. A total of 55 public HEIs consisting of 52 out of 112 SUCs and 3 out of 121 LUCs participated in the Digital Readiness Assessment Survey (DRAS), while 49 public HEIs consisting of 46 SUCs and 3 LUCs participated in the Digital Maturity Assessment Survey (DMAS). Many of the participants overlapped. No private HEIs participated in either

[28] CHEDRO3 (CHED Regional Office 3) 2020. CHED HIED BAYANIHAN. Accessed April 2022, from Commission on Higher Education Regional Office 3: https://chedro3.ched.gov.ph/2020/10/16/ched-hied-bayanihan/.

[29] The original survey instruments were developed by a digital transformation expert (Hage 2015a; 2015b) and contextualized for the Philippines. The instruments have been used in countries such as Canada, New Zealand, Spain, Kenya, Ghana, Ethiopia, Senegal, Nigeria, Zambia, Tunisia, and Iraq. The surveys consisted of questions with answers as Likert-type ratings. For the DRAS, the maximum possible score per dimension is 7, resulting in a total of 35 points; whereas the minimum possible score per dimension is 1, resulting in a total of 5 points. For the DMAS, the maximum possible score per dimension is 25, resulting in a total of 125 points; whereas the minimum possible score per dimension is 5, resulting in a total of 25 points.

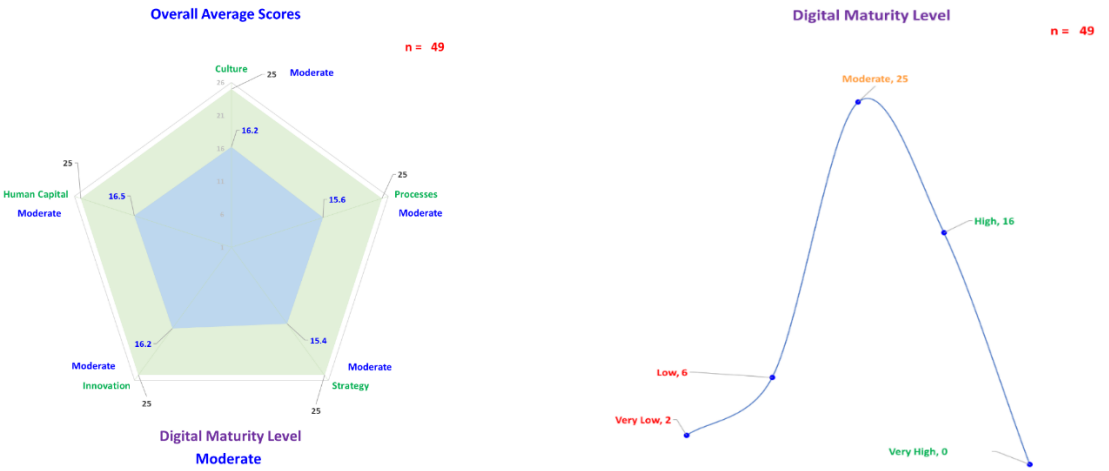
survey. In terms of digital readiness, HEIs had on average a very good level of readiness for strategy, culture, and process, but only good in human capital and innovation (Figure 7). In terms of digital maturity, HEIs were found to be moderately digitally mature in all dimensions (Figure 8). The survey results suggest that HEIs have taken critical initial steps toward digital transformation, i.e., digitization and digitalization, but they have yet to reinvent and shift their institutional culture, workforce, and technology to enhance their value proposition, operations, and strategic directions. Also, the level of readiness and maturity varies across HEIs. Even though the majority of participating HEIs show very good readiness and moderate maturity, about 10 percent show poor readiness and maturity. Private HEIs are not represented at all in these surveys but given that it was difficult or not possible to reach out to the vast majority of private HEIs for various surveys conducted for this report, it is likely that only a limited number of private HEIs are ready and mature for digital transformation, whereas the majority of small private HEIs need more investment and time to improve digital readiness and maturity.

Figure 7. Digital Readiness of Public HEIs in the Philippines



Source: World Bank survey.

Figure 8. Digital Maturity of Public HEIs in the Philippines



Source: World Bank survey.

1.3. Country Context for Digital Transformation

Promoting the use of ICT and moving forward with digital transformation requires not only government buy-in, but also heightened public awareness and increased support from the private sector and development partners. Institutionalizing a digital transformation strategy requires an executive mandate that holds local and national government institutions accountable for leading the implementation of key actions. In addition, these actions must be incorporated into the annual budgets and plans of government agencies, and they must be reflected in the overall national development plan. Legislation related to ICT development, particularly in digital governance, cybersecurity, privacy, and procurement is necessary and urgent. Furthermore, the public must see the value of ICT in improving the quality of social services and accessibility of information as they will be the major users and advocates of this technology. Partnership with the private sector and international organizations can be helpful not only in implementing strategies and programs, but also in advocating for policy reforms and raising public awareness (CICT 2014). To aid in understanding the country context, this section discusses: (i) digital skills gap; (ii) the evolution of the national digital transformation strategy; and (iii) key policies and regulations on digital transformation in the Philippines.

1.3.1. Digital Skills Gap

This section reviews the demand and supply of jobs and digital, technical and non-technical skills in the Philippines. In addition to a literature review of international rankings in digital skills and survey results, data on skills demand and supply and skills gaps in the Philippines were collected from the following sources: surveys of higher education students and administrators, job search websites, and career development services. The first section reviews where the Philippines stands in terms of digital and ICT skills relative to other countries in the region and the world. The second section analyzes the kind of digital skills and the level required by various industries in the Philippine economy today, as well as the skills gaps in emerging professions that require high-level and middle-level skills. The third section analyzes the mismatch in digital skills based on a survey of students' work skills and their desired jobs.

1.3.1.1. Overview

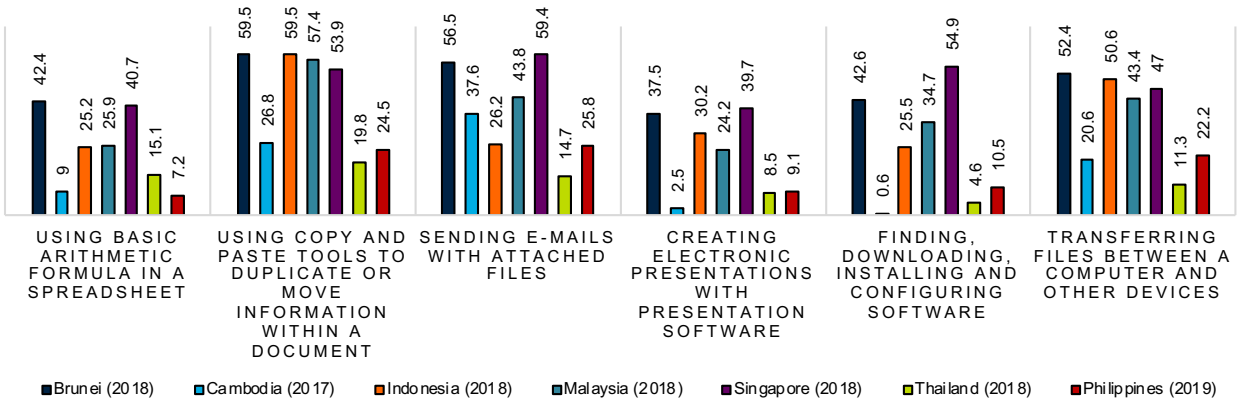
Along with a weak digital infrastructure, poor digital skills and low level of digital literacy in general have been recognized as obstacles to digital transformation in the Philippines.[30] The National ICT Household Survey 2019 reveals that over a quarter (26.7 percent) of individuals in the Philippines do not use the internet because they do not know how to use it. The survey further finds that only a quarter (25.8 percent) of youth and adults possess basic ICT skills such as sending e-mails with attached files, while less than one in 10 can perform skills such as using basic arithmetic formulas in a spreadsheet (7.2 percent) or creating electronic presentations using a presentation software (9.1 percent). Across these skills, the Philippines lags behind nearly all neighboring countries in the region, faring only slightly better than Cambodia and Thailand in certain skills (Figure 9).[31] Compared with regional peers (Figure 10) in a study on digital trends in the Asia and Pacific region (ITU 2021), the Philippines has a significantly lower share of individuals who were found to possess basic skills (e.g., using copy-and-paste tools to duplicate or move information within a document), standard ICT skills (e.g., using basic arithmetic formulas in a spreadsheet), and advanced ICT skills (e.g., writing a computer program using a specialized programming

[30] Digital skills are broadly defined as the ability to effectively navigate digital technologies in order to access, manage, understand, integrate, communicate, evaluate, and create information safely and appropriately. UNESCO 2018. A Global Framework of Reference on Digital Literacy Skills for Indicator 4.4.2. Quebec: UNESCO-UIS.

[31] On average, nearly the same proportions of men and women are able to perform each type of ICT skill. However, among individuals ages 10 to 24 years old, more females appear to be skilled in ICT, while among working age adults ages 25 years and older, more males appear to be skilled in ICT.

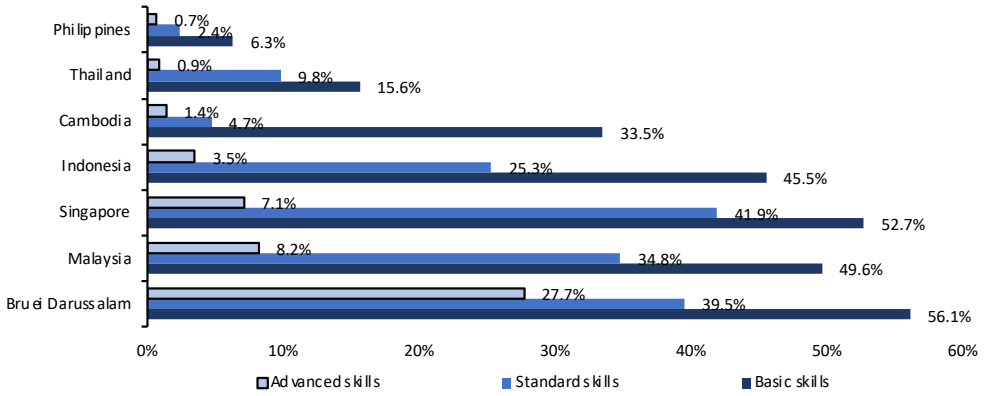
language). Furthermore, in the International Institute for Management Development (IMD) World Digital Competitiveness Ranking 2021,[32] which measures the capacity and readiness of 64 economies to adopt and explore digital technologies as a key driver for economic transformation in business, government and the wider society, the Philippines ranked 54th on the digital/technological skills indicator and 58th on the overall index for digital competitiveness, a considerable drop from 46th in 2017. According to IMD (2020), the decline in the country's performance "reflects the weakening of the talent and training and education sub-factors" (p. 22).

Figure 9. Regional Comparison of Proportions of Youths and Adults with ICT Skills (SDG 4.1.1)



Sources: Data for the Philippines are from NICTHS 2019, DICT, and PSRTI https://dict.gov.ph/ictstatistics/nicths2019/. Data for all other countries are from the UN Global Sustainable Development Goals Database https://unstats.un.org/sdgs/indicators/database/.

Figure 10. Regional Comparison of Basic, Standard, and Advanced ICT Skills, 2017-2019



Source: ITU 2021. *Digital trends in Asia and the Pacific 2021. Information and communication technology trends and developments in the Asia-Pacific region, 2017-2021*. Accessed from https://www.itu.int/dms_pub/itu-d/opb/ind/D-IND-DIG_TRENDS_ASP.01-2021-PDF-E.pdf.

With the rapidly changing labor market demand in the 21st century, developing adequate digital and ICT skills will be critical for the future workforce. The impacts of the shift to increasingly advanced technologies will include the replacement of manually intensive jobs by automation and IT-controlled processes. To adapt to this rapidly changing environment, education and training institutions will need to ensure that they are developing the right skills for adequate workforce preparedness (ILO 2020). According to LinkedIn's *2020 Emerging Jobs Report*, for instance, the 10 fastest growing jobs in the Philippines are commonly characterized by digital and ICT skills, such as those required for the roles of cyber security

[32] IMD World Competitiveness Center 2021. IMD World Digital Competitiveness Ranking 2021. https://www.imd.org/globalassets/wcc/docs/release-2021/digital_2021.pdf

specialists, data scientists, and data engineers (LinkedIn 2020).

To meet the demands in the 21st century, HEIs can play a critical role in upskilling and reskilling, particularly through strengthening linkages with industries. With the changing nature of work, individuals will need to *upskill* or learn new skills for existing jobs, or they should *reskill* or learn new skills for different jobs. Upskilling strategies include updating the HEI curricula and training opportunities. HEIs can also participate in reskilling by strengthening opportunities for lifelong learning and providing alternative credentials such as digital badges and micro-credentials,[33] which current employees may undertake through industry partnerships (ILO 2020). Strengthening academe-industry linkages can help close the skills gaps by ensuring that the current supply of worker skills meets industry needs. All these will require a faculty that has the appropriate skills to deliver digitally enhanced instruction. HEI faculty and staff may need support in using learning management systems; integrating other technologies into these systems, e.g., video conferencing and curating content that is aligned with the curricula; and developing appropriate blended learning options for students in remote and disadvantaged contexts (World Bank 2020d).

1.3.1.2. Demand for 21st Century Skills and Cross-Cutting Digital Skills

Ten key industries generate a considerable number of employment in the Philippines, all of which require 21st century skills and various levels of digital skills, with some common across industries while others unique to a particular industry. The Philippines has dramatically benefited from global technological advances that energized the global services trade and from the digitalization of its economy, including the promotion of new jobs such as robotics, artificial intelligence, and materials engineering. According to the Department of Labor and Employment (DOLE), these 10 key industries generate a large number of employment: (i) information technologies – business process management (IT-BPM); (ii) agriculture, forestry, fisheries, and agribusiness; (iii) construction; (iv) transport and logistics (air, water, and mass rail transport); (v) maritime; (vi) manufacturing (electronics and semi-conductors, aerospace and automotive industries); (vii) banking and finance; (viii) hotel, restaurant, and tourism; (ix) health and wellness; and (x) education. Cross-cutting skills required by today's industries include: advanced materials, artificial intelligence (AI), and augmented reality/virtual reality/mixed reality technologies (AR/VR/MR), autonomous systems, big data analytics, biotechnology, blockchain technology, Internet of Things (IoT), nanotechnology, satellite technologies, sensors and imaging, 3D printing, and 5G wireless technology. In addition, all of these industries require industry-specific technologies. (See Annex 2 for detailed list of digital skills in high demand.)

Similarly, the Philippine Skills Framework (PSF) of the Department of Trade and Industry (DTI) is an inter-agency effort to build the skills and competencies of the country's human capital and workforce to prepare Filipinos for the future economy by linking sector-specific skills demand and workers' skills. Launched in 2021, the PSF Initiative aims to develop sector-focused skills frameworks that can help employers identify skills and competencies for potential employees as well as upskilling plans for current employees; support workers in seeking jobs or career advancement; and guide educational and training institutions in enhancing their curricula and courses. Modeled after SkillsFuture Singapore (SSG)'s experience in implementing national skills frameworks, PSF aims to publish a common sector-specific reference for employers and workers that can ensure a match between employment opportunities and workers' skills with the following sector-specific information: (i) the employment landscape; (ii) job roles and corresponding worker profiles; (iii) skills and competencies definitions and possible training programs; and (iv) career pathways. Aside from upskilling Filipino workers, the PSF also focuses on the development of competitive Filipino enterprises (DTI 2021).

[33] In their report on the EUA's DIGI-HE project, Gaebel et al. (2021) define digital badges (or e-badges) as a "validated indicator of accomplishment, skill, quality, or interest that can be earned in various learning environments" (p. 7); and micro-credentials as "proof of the learning outcomes that a learner has acquired following a short learning experience" (p.7).

Yet, the demand for skills is rapidly changing; many of the jobs in high demand today could no longer be in demand in the near future: no sector is immune to the changes brought about by AI, data science, blockchain, augmented reality and virtual reality, robotics, and 3D. A study shows that on average, around 65 percent of all jobs in the Philippines will be affected in varying degrees in different industries (Francisco et al. 2019). For instance, call center services that consist of 50-60 percent of jobs in the BPM sector in the Philippines are highly vulnerable to developments in AI and the emergence of chatbots. The risk of losing a job in the finance and insurance sectors is as high as 79 percent, construction 76 percent, manufacturing 65 percent, and wholesale and retail 54 percent.

Data from LinkedIn (2020) identify many emerging professions and job titles in the country that require high-level digital skills. Among the top 10 emerging professions in order of industry demand are robotics engineers, cybersecurity specialists, customer success specialists, data scientists, sales development representatives, full stack engineers, DevOps engineers, data engineers, JavaScript developers, and cloud engineers (see Annex 3 for details). These professions are needed the most in information technology and services, computer software development, financial services, and the outsourcing industry. Most of these professions or job titles did not exist a decade ago, and it is likely that today's technologies will spawn more new job titles. Therefore, the training and education sectors need to continue adjusting their programs to respond to future skills needs.

An analysis of jobsites data using data science and AI enables the identification of granular information about the skills necessary for each job title. Specifically, an analysis of the skills that are in high demand in specific job titles can help HEIs develop more relevant curricula, syllabi, and course offerings to meet the demand (HeadAI 2022). Box 3 shows how technologies can be used to enhance career guidance and curriculum alignment. For example, call center agents and business analysts are two of the most in demand jobs in the Philippines. Key skills required for these jobs include both technical and soft skills. Call center agents must have skills such as customer focus, program development, marketing of services, data processing, and data security. Business analysts must have technical skills in computing, data management, business software development, project management, systems design, IT analysis, requirements analysis, and business systems analysis; as well as soft skills such as agility, written communications, customer care, and ability to work in teams (see Annex 4 for the detailed list of skills required for these job titles).

Box 3: Using Technologies to Enhance Career Guidance and Curriculum Alignment

HEIs can use digital technologies to enhance the quality and relevance of their services to better support students. The first section reviews available career guidance services and the use of digital portals in HEIs. The second section presents how a Skills Profiling Report for Individuals (SPRI) tool can help students navigate their career paths. The third section presents how data science and AI can help align the higher education curriculum with the demand for jobs and skills as well as career guidance at HEIs.

Use of Data and Digital Tools for Job Search

Majority of colleges and universities provide some form of career guidance but only about 39 percent of HEIs surveyed had dedicated digital portals for career guidance. To successfully transition from school to work, students need to be guided with adequate information on skills requirements and available career options. Two online surveys—one for 126 HEI administrators and the other for 3,381 students—conducted by the World Bank in February 2022 found that nearly all HEIs offer some form of student career guidance and counseling. All SUCs surveyed had a dedicated office for career guidance with a career counselor, while only 58 percent of private autonomous HEIs had such career guidance service, 62 percent of private deregulated HEIs, 41 percent of private

about 39 percent of all HEIs reported to have installed such a system—the highest among these schools are the private autonomous schools (63 percent) and the lowest are the private regulated schools (27 percent). The findings suggest that many HEIs have yet to digitalize student career guidance to improve its quality.

Students in the Philippines use various jobsites as well as social and professional network sites in their job search. The World Bank February 2022 survey revealed that many higher education students search jobs using the following sites: Linkedin.com (75 percent), Jobstreet.com (70 percent), Indeed.com (20 percent), Bossjob.ph (10 percent), Kallibrr.com (6 percent), Jobaxy.com (5 percent), and Rarejob.com (8 percent). Students also use social network and professional network sites for their job search. The most popular sites are the Facebook pages of their own universities/colleges (67 percent), the Facebook pages of private companies and organizations (61 percent), and LinkedIn (60 percent).

A digital platform for matching talent with job opportunities is also available from DOLE. Careerinfo.ph (http://careerinfo.ph/) by DOLE's Bureau of Local Employment serves as an information resource on careers and job opportunities. Job information briefs are provided with specific functional descriptions, educational requirements, and relevant skills and qualifications. The site also provides career guidance materials and access to PhilJobNet, which is an internet-based job and applicant matching system for jobseekers, employers, and overseas recruitment agencies.

Skills Profiling Report for Individuals

AI and predictive analytics help students navigate their career development. The World Bank piloted the Skills Profiling Report for Individuals (SPRI) method developed by JobKred (Singapore)34 to assess a student's skills and match them with the forecast demand for those skills. The methodology uses data science and AI to process huge volume of information on jobs and skills available from jobsites and other sources. Using this method, students are able to (i) identify the skills that match the current in-demand jobs; (ii) know their current qualifications and skills; (iii) identify their chosen or favored career path; and (iv) know the skills that are required to pursue their chosen or favored career path. Furthermore, the method allows users (students) to benchmark against similar profiles and career pathways. Thus, a student can develop and pursue alternative career pathways and know the specific skills required for that career. Upon completion of the pilot skills assessment in the Philippines, students were provided with a 25-page detailed report of their skills portfolio, which includes their work skills, experience, and education; and their career portfolio, which offers career recommendations that match their skills, and which the students can use in exploring their career pathways.

Using data science and AI for curriculum alignment

Data science and AI can be used to align higher education curriculum with the demand for jobs and skills. Using a curriculum navigation tool developed by HeadAi of Finland that applies cognitive AI and predictive analytics, a World Bank study explored curriculum alignment in 19 HEIs the Philippines.35 Through machine learning, the tool automatically identifies trends such as changes in the demand and supply of skills in the regional and international markets. To determine the skills supply, the 10 HEIs provided their curricula and syllabi for courses

[34] The method has been applied in Singapore, and also in other countries including Indonesia, Myanmar, and in seven countries in Africa.

[35] The 19 universities were Batangas State University - The National Engineering University, Bukidnon State University, University of the Philippines System (comprised of UP Diliman, UP Los Banos, UP Manila, UP Visayas, UP Open University, UP Mindanao, UP Baguio, and UP Cebu), Mapúa University and its subsidiaries Malayan Colleges Laguna and Malayan Colleges Mindanao, Iligan Medical Center College, University of the East - Manila, Samar State University, Mariano Marcos State University, Tanauan City College, and Jose Rizal University. The curriculum navigation tool has been used in universities in Finland and applied elsewhere in the world including Kenya and other countries.

in health sciences, IT and computer science, and business administration. For skills demand, the curriculum navigation tool identified the jobs and skills that were in high demand. The goal is to look for strong correlations between demand and supply of skills (see Annex 5 for the detailed methodology used in skills demand and supply in the Philippines study).

1.3.1.3. Skills Gap

Skills shortages are prevalent among jobs that require high-level and middle-level skills. DOLE published the *JobsFit 2022 Labor Market Information Report* (DOLE 2021), which addressed unmet demand for high-level and middle-level skills in specific job titles across industries in the labor market. Skills shortages are pervasive in high skills areas such as business services and administration, advertising and public relations, sales and marketing, financial analysis, computer network operation, software development, and IT user support. It is also difficult to fill middle-skills jobs such as plant and machine operators, contact center and customer representatives due to lack of relevant skills. The list of unmet skills demand can guide learners and students on the skills required in specific professions, while skills development service providers can use it to align their course offerings and syllabi with the skills desired in future careers or professions. The jobs that are in high demand were shown to require not only basic and intermediate digital skills but also advanced and specialized digital skills such as computer network operation, IT and user support, and software development, in addition to hard skills such as financial analysis and business services (see Annex 6 for a list of in-demand and hard-to-fill occupations, 2013-2020.)

Based on an algorithm that matches the forecast demand for skills and predictive analytics using demand data from jobsites, considerable gaps in digital skills and other skills are observed among students, which vary by the type of careers chosen.[36] A World Bank survey (2022) analyzed the responses of 641 higher education students from 19 sample colleges and universities in the Philippines about their work skills, experience, and education as well as their most desired jobs and careers. A large percentage of the sample students came from the healthcare sector, IT and computer science, and business administration. Because of the specializations of the participants, a large number of the top careers chosen included medical officer, physician, nurse, epidemiologist, lab assistant (healthcare), software engineer, programmer, game programmer, web developer, Python developer, data analyst, UI developer and UI designer, web software developer, security engineer (IT and computer science), business analyst, project manager, and consultant (business administration). Within the career paths that the participants favored or chose, the analysis identified roughly 10,000 unique missing skills (skills gaps). They include knowledge of Windows, search engine optimization, social media marketing, blogging, and data analysis. Other missing skills include soft skills such as team leadership, problem solving, coaching, and public speaking, in addition to hard skills and technical skills such as data analysis, strategic planning, and business strategy (see Annex 7 for job titles favored by students vs. missing skills).

1.3.2. The Evolution of the Philippine Digital Transformation Strategy 2022

The Philippine Digital Transformation Strategy 2022 was developed after a long history of government effort to use ICT for economic development and effective delivery of public services. Since publishing the National Information Technology Plan for the 21st Century in 1997, the government has undertaken a number of key initiatives and developed policies on the use of digital technology. In 2004, the Commission on Information and Communications Technology (CICT) was created to promote, develop, and regulate integrated and strategic ICT systems and reliable

[36] See the background paper by Garcia & Imaizumi (2022) for the details of the survey methodology.

and cost-efficient communication facilities and services.[37] In 2006, CICT published the 2006-2010 Philippine Strategic Roadmap for the Information and Communications Technology Sector. Building on the foundation set forth by the Roadmap, in 2014, the CICT developed the 2011-2016 Philippine Digital Strategy (PDS). The PDS aimed to support the Philippine Development Plan (PDP) 2011-2016 in pursuing digital initiatives that move the country towards a digital economy. The PDS had four strategic thrusts: i) transparent government and efficient services; ii) internet opportunities for all people; iii) investing in people: digital literacy for all; and iv) ICT industry and business innovation for national development (CICT 2014). In 2016, the DICT replaced the CICT (Republic Act No. 10844 2016).[38] Most recently, DICT published the Philippine Digital Transformation Strategy 2022 with a mission to "embed the pursuit of service-orientation, procedural efficiency, and behavioral transformation into the very fabric of government operations" (DICT 2021a p. 15).[39]

Over the past decade, CICT/DICT developed several programs and projects to support the pursuit of digital transformation in the Philippines, but the effectiveness and implementation status of these programs needs a thorough review. Table 3 summarizes these key programs and projects from 2012. Many of the initiatives share similar objectives, i.e., to provide better access to online government services and ICT-related resources across the country, particularly targeting disadvantaged citizens in underserved areas. Despite the good intentions, many of the programs seem to have not been implemented, only partly implemented, or discontinued.

Table 3. Key Programs and Projects Supporting Digital Transformation in the Philippines

YEAR	INITIATIVE	DESCRIPTION	CURRENT STATUS
2012	Integrated Government Philippines Program (iGovPhil)	The program aims to provide the necessary infrastructure and software to implement a strong e-Governance system.	Partially implemented; was in Phase III implementation as of July 9, 2018[1/]
2016	Technology Empowerment for Education, Employment, Entrepreneurship, and Economic Development (Tech4ED)	The project aims to provide access to ICT-enabled services and relevant content to rural communities that have minimal or no access to internet.	Active as of 2022[2/]
2012	Medium-Term Information and Communications Technology Harmonized Initiative (MITHI)	The initiative aims to harmonize the process of planning, budgeting, implementing, monitoring, and evaluating ICT-related resources, programs, and projects across agencies.	Discontinued in 2021[3/]
2016	Free Wi-Fi for All Program	The program aims to provide internet access in public places throughout the country to support knowledge building among citizens.	Active as of 2022[4/]
2017	National Broadband Plan (NBP)	The plan aims to improve affordability, availability, and speed of broadband capacity, particularly in underserved areas around the country.	Document published in 2017; Phase I implementation was yet to begin in 2021[5/]

37 Executive Order No. 269, Series of 2004.

38 Under Republic Act No. 10844, the following agencies were attached to DICT: the National Telecommunications Commission, the National Privacy Commission, and the Cybercrime Investigation and Coordination Center. DICT thus oversees ICT matters in a broad range of areas, including telecommunications and broadcasting, data privacy, cybersecurity, consumer protection, and promotion of trade and investment in ICT and ICT-enabled services (Barcenas 2019). https://dict.gov.ph/wp-content/uploads/2016/05/RA10844_DICT.pdf. Under Republic Act No. 10844, the following agencies were attached to DICT: National Telecommunications Commission, National Privacy Commission, and Cybercrime Investigation and Coordination Center. DICT thus oversees ICT matters in a broad range of areas, including telecommunications and broadcasting, data privacy, cybersecurity, consumer protection, and promotion of trade and investment in ICT and ICT-enabled services (Barcenas 2019).

39 DICT 2021. Philippine Digital Transformation Strategy 2022.

YEAR	INITIATIVE	DESCRIPTION	CURRENT STATUS
2019	National ICT Ecosystem Framework (NICTEF)	The framework encourages government, businesses, and civil society to become part of a unified national ICT ecosystem that is equitable and inclusive and that promotes sustainable development.	Document published in 2019. No official project updates found online after 2019.
2022	e-Government Master Plan (EGMP) 2022	The plan is an update to the EGMP 2013-2016, which is a blueprint for creating a harmonized, interoperable, and integrated e-Government system.	Document published in 2019[6/]

Source: Compiled by the authors.

1/ Website inaccessible as of June 17, 2022 (https://i.gov.ph/). Last update shows Phase III implementation as of July 9, 2018 (https://dict.gov.ph/major-programs-and-projects/e-government-harmonization/integrated-government-philippines-igovphil/).

2/ As of May 2021, DICT reported establishing new Tech4Ed Centers in Pangasinan (https://dict.gov.ph/dict-launches-tech4ed-centers-in-pangasinan/). Digital literacy content was uploaded in the last 3 weeks under the Tech4Ed Project - DICT Region 3 YouTube channel (https://www.youtube.com/channel/UCt8WQw4HnnoQG-IM7FAs2yw). A job opening announcement was posted last April 2022 on the Tech4Ed Centers Facebook page (https://www.facebook.com/Tech4EDCenters/). However, the website indicated in the Project Brief in its early stages (http://www.tech4ed.gov.ph/) is currently inactive (https://psa.gov.ph/sites/default/files/7.6.3%20Tech4Ed.pdf.

3/ By virtue of https://www.dbm.gov.ph/wp-content/uploads/Issuances/2021/Joint-Memorandum-Circular/DBM-DICT-NEDA-JMC-No-2021-01.pdf.

4/ DICT lists live sites as of June 15, 2022 (https://freepublicwifi.gov.ph/livehotspots/). However, the implementation may be ineffective due to limited bandwidth.

5/ Document published in 2017: https://dict.gov.ph/wp-content/uploads/2017/09/2017.08.09-National-Broadband-Plan.pdf. Article indicating that Phase 1 was yet to begin: https://opengovasia.com/the-philippines-to-set-up-resiliency-route-for-national-broadband-programme/.

6/ Last update found on the DICT website indicates that the document was uploaded in 2020 (https://dict.gov.ph/ictstatistics/wp-content/uploads/2020/03/EGMP-2022.pdf). Most recent article found (dated Jan 31, 2022) was about its launch and what needs to be done to accelerate "digital adaptation" in the PH (https://www.blog.attachedocs.com/accelerating-digital-adaptation-in-ph-whats-left-to-do-in-2022/).

1.3.3. Policies and Regulations for Digital Transformation[40]

1.3.3.1. Cybersecurity Policy and Regulations

The Cybercrime Prevention Act of 2012 (RA 10175) was enacted to "prevent and combat" cybercrime and create the inter-agency Cybercrime Investigation and Coordinating Center (CICC) under the Office of the President. CICC is responsible for formulating a national cybersecurity plan, monitoring cybercrime cases, and recommending further enactment of policies relating to cybersecurity, among others.[41] In 2017, DICT launched the National Cybersecurity Plan 2022 to protect critical infostructures, public and military government networks, businesses and their supply chains, and "every Filipino using the internet" (DICT 2017b). However, according to an analysis by a Philippine cybersecurity coalition called Secure Connections, cybersecurity has not been seen as a top priority in the Philippines (Secure Connections 2022). Among the recommendations of the analysis were: (1) for the Philippines to adopt "a policy enforcing a minimum level of security protection" that would apply across key sectors that are working on their own digitalization initiatives; and (2) developing a cybersecurity culture to address the cybersecurity skills gap, including offering cybersecurity courses in Philippine colleges and universities in partnership with recognized international course providers (Secure Connections 2022).

40 See Annex 3 for other policies and regulations on digital transformation.

41 The Act defines cybercrime as any of the following: (a) offenses against the confidentiality, integrity, and availability of computer data and systems, such as illegal access, illegal interception, and data interference; (b) computer-related offenses, such as computer-related forgery, fraud, and theft; (c) content-related offenses, such as cybersex, child pornography, unsolicited advertising, and libel; and (d) other offenses such as aiding, abetting, or attempting to commit cybercrime (RA 10175, 2012).

1.3.3.2. Personal Data Protection Law

Cognizant of the Philippines' increasing reliance on data, the Data Privacy Act of 2012 (RA 10173) was enacted to protect the right to privacy while ensuring the free flow of information that is needed for innovation and growth. The Act established the National Privacy Commission (NPC), which is mandated to: "(i) be the authority on data privacy and protection, providing knowledge, know-how, and relevant technology; (ii) establish a regulatory environment that ensures accountability in the processing of personal data and promotes global standards for data privacy and protection; (iii) build a culture of privacy, through people empowerment, that enables and upholds the right to privacy and supports free flow of information" (NPC n.d.). To involve as many sectors as possible in promoting data privacy and data privacy accountability, NPC created the Data Privacy Council (DPC) in 2018. The DPC is responsible for creating sectoral privacy codes; it meets on a quarterly basis to discuss awareness building and compliance, although no such privacy codes have been released (Jacob 2022).

1.3.3.3. The Philippine Government's Cloud First Policy

The Philippine Government's Cloud First Policy, including its amendments, provides direction on policy coverage, as well as the classification, security, sovereignty, residency, and ownership of data in the cloud. DICT Department Circular No. 2017-002 promotes cloud computing as the preferred technology for government administration and delivery of government services. First, it mandates the adoption of a "cloud first" policy for various national government agencies and instrumentalities, as well as private entities rendering service to the government. Second, it states that the Philippines shall have sovereignty over all data in the cloud that is created, collected, organized, modified, retrieved, used, consolidated, sourced from, or owned by the Philippine government, regardless of location. Finally, it updates data classifications to guide the application of safety protocols. Through this policy, cloud computing is prioritized to foster flexibility, security, and cost-efficiency among users through access to a global system of solutions, innovations, services, and up-to-date cybersecurity measures. The amendment of the Cloud First Policy through DICT Department Circular No. 010, Series of 2020 aims to address the issues and needs resulting from the shift to cloud that was necessitated by "the new normal" (DICT 2020d).

1.3.3.4. E-Governance Act of 2020

In July 2020, the E-Governance Act of 2020 (Senate Bill No. 1738) was filed to institutionalize the transition to a system of e-Governance during the pandemic (ARTA 2021). The proposed law seeks to utilize modern technology to improve the delivery and public access to government services by mandating the establishment of "an integrated, interconnected, and interoperable information and resource-sharing and communications network spanning the entirety of the national and local government, an internal records management information system, an information database, and digital portals for the delivery of public services" (Senate of the Philippines 2021). The legislation is yet to be enacted.

1.4. Summary of Findings

This chapter reviewed i) the current state of the Philippine higher education sector; (ii) the sectoral context of pursuing digital transformation at the sectoral and institutional levels; and (iii) the country context surrounding digital transformation of higher education.

The review of the higher education sector suggests that the urgent needs brought by the pandemic accelerated the digital transformation of higher education. Most HEIs have struggled to respond to the unexpected and sudden need to use digital technology in flexible learning. CHED has provided financial and technical support to HEIs to transition to digital learning. However, the overall investment needs are

substantial, and they need to be addressed if the sector is to upgrade its digital infrastructure, provide an efficient and effective digital network, and build the digital capacity of the entire higher education sector. Quality assurance takes place on a voluntary basis, so most institutions and programs, including online programs, do not go through a rigorous quality assurance process. Given the limited digital facilities in place on campus and at home, and the weak digital capacities among faculty members, students and administrators, the majority of HEIs have yet to adopt the technology to enhance the quality and relevance of their education services. The pandemic also increased the digital divide between private and public HEIs, between urban and rural locations, and among students from different socioeconomic background.

The rapidly changing economy has increased demand for digital skills, but digital skills among Filipinos are relatively weak compared with neighboring countries in the region. In addition, the pandemic accelerated the demand for basic digital skills needed for daily life and simple jobs as well as the advanced new technologies for emerging industries and jobs. Surveys and AI-based analyses identified the cross-cutting digital and non-digital skills that are in great demand as well as the gaps between the university curriculum and the skills needs in the labor market. To respond to labor market demand, the development of micro-credentials for skills that are in high demand can help students find a suitable job, and for industries to find suitable employees. Technologies can be effectively used to help HEIs provide tailor-made career guidance to students and align their curriculum with market demand.

The review of relevant national policies and programs suggests that digital transformation is a national priority that can help the country transition to an upper middle-income country. The government, led by DICT, has invested in a number of initiatives to support the development of digital infrastructure and training programs on digital skills. The government has developed relevant policies and regulations to support the smooth implementation of digital transformation, for instance, by enhancing cybersecurity and protecting data privacy. However, the investment has been limited and leaves room for a more holistic, coordinated, and most importantly, strategic approach. Some other key laws such as on access to information and freedom of information need to be enacted.

Foundations of Digital Transformation

CHAPTER 2

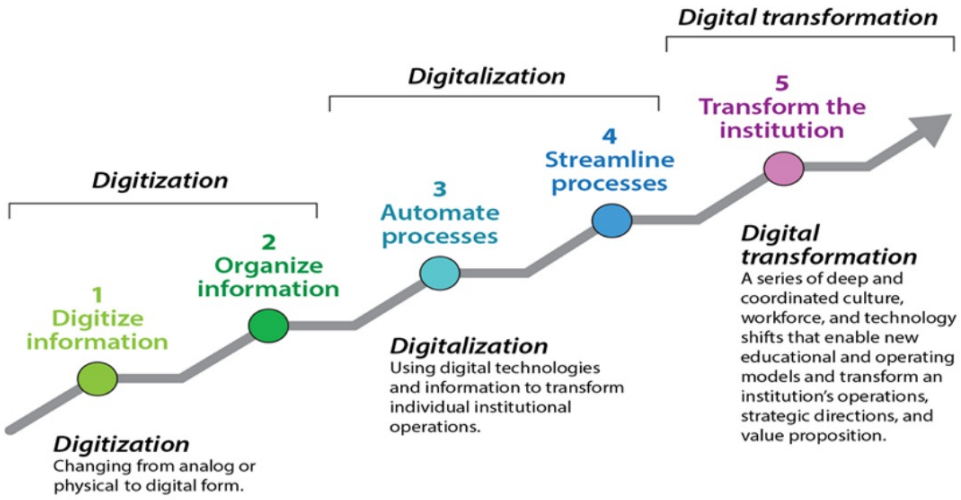
Foundations of Digital Transformation

This chapter discusses the foundations of digital transformation. It starts with a definition of what digital transformation is, and then moves to a thorough analysis of the skills necessary for successful adaptation of digital solutions. These solutions are discussed in the second section, covering the building blocks of common and shared platforms and services that support university life. The last section covers challenges, solutions, and standards related to information security on campus.

The digital transformation of higher education is a large and complex area of analysis with implications for the full range of operations in HEIs. The stakeholders of higher education—leaders, staff, and students—use a diverse range of digital technologies in their everyday tasks. These include common solutions that are not education-specific, such as cloud computing, wireless networks, mobile devices, and communication tools. Emerging technologies, such as blockchain, artificial intelligence (AI), robotics and data analytics, are also used in various higher education systems. These technologies continuously develop and expand in terms of their computing power, functionality, and potential use. Taken together, they constitute a digital technology ecosystem which is potentially stronger and more functional than its individual components because they interoperate and complement one another, thus enabling new possibilities.

Digital transformation is "a series of deep and coordinated culture, workforce, and technology shifts that enable new educational and operating models and transform an institution's operations, strategic directions, and value proposition" (Brooks & McCormack 2020). Digital transformation (DX) is often interchanged with *digitization* (of analog information) and *digitalization* (of processes). However, DX is different as it is more complex and more impactful (Figure 11). Most fundamentally, digital transformation requires organizational and cultural shifts. Changes in organizational culture are essential to achieve a successful digital transformation. DX will stimulate a new culture and a new mindset, which will require new processes to embrace the effective use of digital tools, improve digital literacy, and foster an open culture of cross-discipline collaboration and innovation that relies on data analytics for decision making and planning.

Figure 11. Digital Transformation is about Culture, Workforce, and Technology Shifts



Source: Brooks & McCormack 2020.

To achieve digital transformation, HEIs must shift their orientation from working in silos to collaborating on institution-wide goals. This requires a culture of openness that that is maintained through new channels of communication and engagement among students and other actors within the HEIs. Without understanding the need for a cultural shift, digital transformation strategies and implementation plans become mere automation projects. The forced adoption of new technologies is often met with active and passive opposition. With such resistance, institutions will almost certainly struggle to keep the lines of communication open between stakeholders, administrators, and departments within the organization.

2.1. Digital Competence Framework

Monitoring digital skills uses a digital competence framework that defines the digital competencies and proficiency levels required in specific degree programs, and which a student or teacher must develop in order to benefit, participate, and contribute to the digital world. To facilitate the transition to a new process and culture, HEIs should establish clear objectives and carefully plan the timing of the transition. Open communication and engagement with stakeholders can be combined with agile and efficient management approaches. The skills necessary for digital transformation are monitored through digital competence frameworks. Typically, digital competence frameworks can be developed for citizens in general or for specific groups such as educators, higher education staff and faculty. There are multiple tools for this purpose and open frameworks for mapping the skills in specific sectors (Table 4). One of the most comprehensive frameworks of digital skills for citizens is the European Union's *DigComp 2.1 Digital Skills Competence Framework for Citizens* and its adaptation by the UNESCO Institute of Statistics (UIS), *A Global Framework of Reference on Digital Literacy Skills for SDG Indicator 4.4.2*. Both have four proficiency levels – basic, intermediate, advanced, and highly specialized, which are further broken down into sub-levels. The framework is especially useful in defining basic and intermediate skills. The *European Framework for the Digital Competence of Educators: DigCompEdu* (Punie & Redecker 2017) is based on a stocktaking of digital education needs and aligning them with education requirements (Caena & Redecker 2019). Adaptation of this framework to the local context in countries is needed in order to develop relevant education courses, training programs, and assessment frameworks (Bashir 2020).

Table 4. Major Digital Competence Frameworks

AUTHOR	TITLE	CONTENT
European Committee for Standardization & European Committee for Electrotechnical Standardization (Cen & Cenelec 2014)	European e-Competence Framework (e-CF) 3.0	A common European Framework for ICT professionals in all industry sectors
Carretero, Vuorikari, & Punie (2017)	DigComp 2.1: The Digital Competence Framework for Citizens	A European framework that defines eight proficiency levels and examples of use to support the development of learning and training materials, assessments of citizens' competence, career guidance, and promotion at work
Organisation for Economic Co-operation and Development (OECD 2019b)	Program for the International Assessment of Adult Competencies (PIAAC)	PIAAC measures adults' proficiency in key information-processing skills—literacy, numeracy, and problem solving—and gathers information and data on how adults use their skills at home, at work, and in the wider community.
International Association for the Evaluation of Educational Achievement (IEA n.d.)	The International Computer and Information Literacy Study (ICILS)	ICILS measures international differences in "students' ability to use computers to investigate, create, and communicate in order to participate effectively at home, at school, in the workplace, and in the community" (IEA).

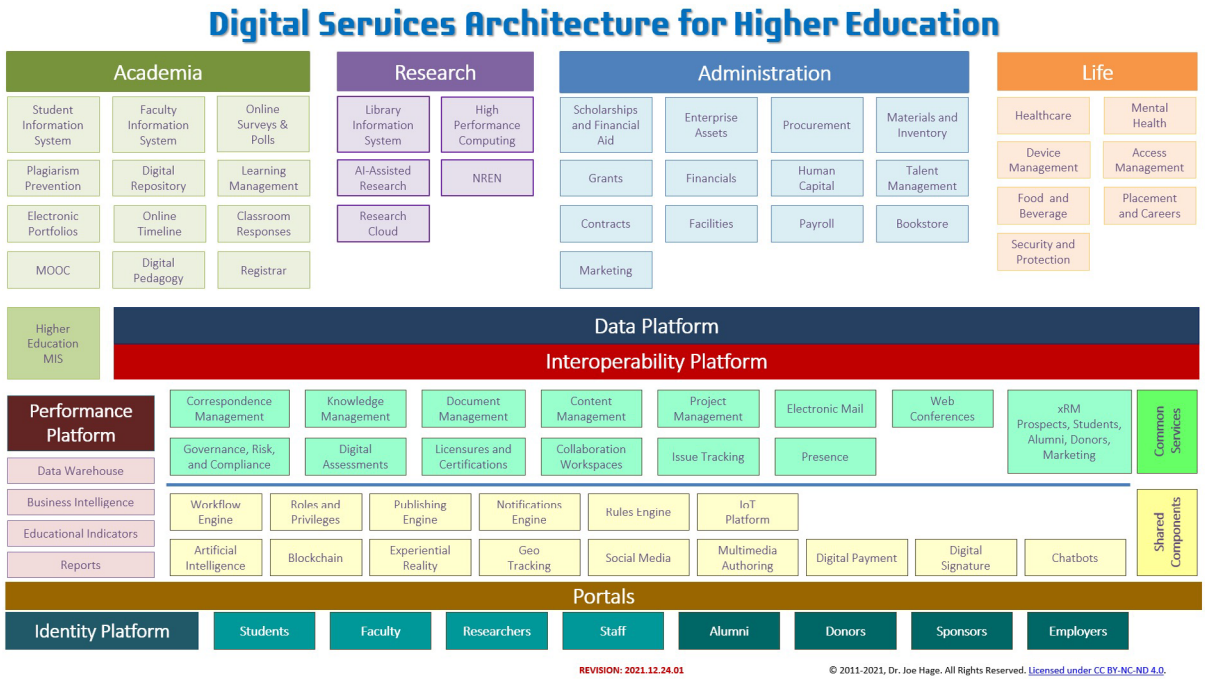
AUTHOR	TITLE	CONTENT
Punie & Redecker, eds. (2017)	European Framework for the Digital Competence of Educators: DigCompEdu	A European framework for developing the digital competencies of educators at all levels
International Telecommunication Union (ITU 2018a)	Digital Skills Toolkit	A country-level toolkit for creating a comprehensive digital skills strategy
United Nations Educational, Scientific and Cultural Organization (UNESCO 2018)	A Global Framework of Reference on Digital Literacy Skills for SDG Indicator 4.4.2	A proposed global framework for supporting the youth in achieving the minimum level of proficiency in digital literacy skills
Bashir (2020)	Digital Skills: Frameworks and Programs	A review of international frameworks for the development of digital skills
HolonIQ (2021)	Higher Education Digital Capability Framework	An open-source framework for mapping and measuring digital capability in higher education
World Bank (2021d; 2021e)	Digital Skills: The Why, the What and the How, Parts 1 and 2	A guidebook for guiding African higher education and technical-vocational education and training (TVET) institutions in creating a rapid-development digital skills country action plan

Note: See the corresponding entries in the References section of this report for the sources of the frameworks.

2.2. Building Blocks for Digital Transformation

The gradual process of digital transformation requires building blocks of common and shared platforms and services that support university life and address the needs of academic, research, and administrative stakeholders. Figure 12 is an example of a digital services architecture for higher education. It ranges from teaching and learning, research, administration, to campus life. Each HEI needs to identify what digital services are needed for its own architecture. Actors in the higher education sector must conduct an inventory of the deployed digital services and applications and leverage existing building blocks, components, and platforms available at the national level or through private sector partnerships. They will determine how to integrate them and build a scalable and robust architecture to offer stakeholders a seamless user experience. The sections in this chapter will describe each block of the architecture.

Figure 12. Digital Services Architecture for Higher Education



Source: Hage 2021.

2.2.1. Academia

The following are the major digital services on education and pedagogy:

- **Student Information System (SIS)** is the core academic information system that holds student records and should be the single source of reliable information on grades, transcripts, assessments, degree evaluation, and registration. The SIS also offers services for faculty members such as class lists, advising pages, daily schedules, and course overrides.

- **Faculty Information System (FIS)** manages faculty records, processes, research studies, and portfolios. The FIS is a one-stop shop for faculty members' profiles, including general information about them, their contracts, positions, and education. The FIS is also home to research activities and documents such as journals, manuscripts, grant research, presentations, service and teaching activities, refereed publications, and conference proceedings.

- **Learning Management** is the core academic system for hosting and delivering teaching and learning activities. It contains course shells for all the courses, i.e., face-to-face, hybrid, and online, with all the needed resources within a course, such as digital books, assignments, attendance, digital certificates, files and resources, quizzes, forums, questionnaires, SCORMs (sharable content object reference models), and other media files.

- **Plagiarism Prevention** is an internet-based plagiarism detection system that promotes academic integrity, streamlines grading and feedback, deters plagiarism, and improves student learning. This system does so by comparing a specific paper with millions of prior submissions to detect similarities and generate reports on the percentage of similarities. This capability is usually integrated within the learning management system to provide a seamless experience for students and teachers.

- **Digital Repository** is a core academic archival system containing all the reusable learning objects used in courses, programs, and libraries. The repository provides the capability to store, search, and

distribute content securely in multiple formats. Distribution of the content could happen in different ways, either via the web or technology channels that allow integration with other content providers, such as learning management systems.

- **Online Timeline** is a vital tool for creating and visualizing timelines and calendars by showing the individual schedules of students, faculty, and researchers; a full schedule for a program; or schedules for facilities utilized in the university. This tool is even more important and useful for advertising online courses and programs.

- **Electronic Portfolios** are personalized collaboration spaces for individuals inside the university. Students and teachers use this capability to create and build their portfolios during their educational journey inside and outside the university and in alignment with the digital competency framework. ePortfolios are usually integrated with the learning management system so that students can post essential projects directly into their ePortfolio or submit their assignments as an ePortfolio section.

- **Online Surveys and Polls** are a set of tools used inside or outside the classroom or learning management systems to survey and poll students, faculty members, and staff; or to gather information about certain research topics.

- **Classroom Responses** consist of hardware and software that provide probes into lectures inside the classroom or learning management system, giving the instructor the capability to determine the level of student understanding of topics. Classroom Responses ensures that students are confident about their level of knowledge in a specific topic before moving on to the next one.

- **Massively Open Online Courses (MOOCs)** are courses developed by the university and made available over the internet either through the university learning management system or through cloud learning management systems. They are usually offered without charge to a big number of people. They are typically self-paced, not instructor-led, and may lead to a digital certificate. (See Box 4 on MOOC platforms for micro-credentials.)

- **Digital Pedagogy** is a service with its associated tools that transforms a learning object, such as a course or a program, to a digital format so that it can be delivered through a technology-assisted face-to-face, blended, or entirely online method. It includes instructional design tools and processes, multimedia production tools, and quality assurance tools.

- **Registrar** is a set of services and functions for digitizing course catalog creation, student registration, class assignments, degree completion, semester configuration, cohort creation, and student record management.

- **Higher Education Management Information System (HEMIS)** is used to plan, manage, and monitor the student life cycle from completion of secondary education through tertiary education and lifelong learning. It is designed for students, researchers, educators, administrators, planners, and government agencies in the higher education sector. HEMIS may include capabilities that complement other academic and administrative systems.

Box 4. MOOC Platforms for Micro-Credentials

Micro-credentials are short courses popularized by leading online course platforms such as Coursera, EdX and Udacity in the United States and are used in many universities in Europe, Australia, Canada, and Malaysia. Micro-credentials, degrees, and certificates offered on shorter, more flexible schedules have been gaining popularity, particularly with the widespread adoption of online learning. Rapid technological changes necessitate a quick upskilling, reskilling, and alignment of higher education workforce skills. Micro credentials provide subject-specific learning experiences as well as flexibility in learning time. The adaptability of micro credentials—which can be obtained online, in person, or through a hybrid model—contributes to this growing trend. There are currently more than 700,000 micro-credentials available from various sources. Coursera, the largest online platform, has over 97 million registered learners and over 2,300 courses (Class Central 2021). It packages individual MOOCs into micro-credentials and brands them as *specializations* or *professional certificates*.

The EdX platform similarly packages its MOOCs into micro-credentials, which it calls *micro-masters* and *micro-bachelors*. Finally, Udacity, an online course platform based in Silicon Valley, calls its micro-credential MOOCs as *nanodegree,* for example, micro-credential *nanodegree* programs for front-end web developers and for engineers specializing in self-driving cars. Using insights from industry surveys, Udacity developed *nanodegrees* in artificial intelligence and automation, natural language processing, software development and DevOps, data science, and machine learning.

Typically, third-party online courses and micro-credentials are not given credit units by HEIs. However, some HEIs are integrating micro-credentials into their own curricula to bridge curriculum gaps and to improve the employability of their graduates. This is the case with the Philippines' Mapúa University where Coursera online courses are offered. In some cases, HEIs include the hours of learning from micro-credentials and online courses as part of a much longer university course—although there is no separate accounting for the credit unit.

Enabling policies are needed to support the credit transfer of online courses and micro-credentials. The experience of early adopters in Asia and Europe provides lessons in implementing this paradigm shift in higher education. In India, Indonesia, and Malaysia, enabling policies and regulatory frameworks allowed course credits to be drawn from external online courses and micro-credentials of up to 30-40 percent of students' academic requirements (Garcia, Perez, & Hayashi 2021). Malaysia is among the first countries in the world to adopt a national policy for crediting online courses and micro-credentials, with the policy supported by implementing regulations that also included quality assurance, assessment, and academic recognition. In Indonesia, a similar regulation enacted in 2018 formalized credit-bearing online courses for academic qualification to boost increased access to tertiary education while improving course quality (Garcia & Stefany 2021). Moreover, the Indonesia Cyber Education Institute (ICE-I) set up a platform consortium of university online course providers where students can earn credit through online courses and micro-credentials.

There are several benefits of allowing credit transfers of online courses: 1) expanded access to higher education without the need to invest in new classrooms; 2) improved access to quality education by taking advantage of content developed by the world's leading experts and best professors; and 3) reduced unit cost of credit-bearing courses, thereby reducing the overall cost of tertiary education. A cost–benefit analysis of online versus in-person teaching in the US showed that online courses cost anywhere from 8 percent to 50 percent less per student credit-hour in five case studies conducted in 2017-2018 by Arizona State University Action Lab and Boston Consulting Group (2018). For the Philippines, the skills gap analysis for this report shows that many of the skills within job streams can be addressed through micro-credentials so that graduates become more employable in the job market. Whether treated as credit courses or not, micro-credentials are helping a good number of students and life-long learners.

2.2.2. Research

The following are the major digital services for research:

- **Library Information System (LIS)** serves as an enterprise resource planning (ERP) system for library administrators, content management for researchers, and a repository of digital credentials for external database subscriptions in HEIs. The LIS tracks physical and digital items, provides the needed space for university-generated research or teaching content, and provides a channel for accessing external research databases and publications.

- **High-Performance Computing** is a set of services, including large-scale computing clusters, that provide the necessary computing power for specific types of research such as genomics, big data analysis, complex simulations, machine learning, and other types of resource-intensive computations.

- **AI-Assisted Research** is a set of services that provide the tools necessary for the use of artificial intelligence in research. It offers several AI engines, such as natural language processing, that facilitate literature analysis, data extractions, and analysis of survey results. It can also be used in image and video processing to enable the analysis of digital images or other media.

- **National Research and Education Networks (NRENs)** are specialized intra-university services aimed at connecting national universities within a country to support research and education needs. NRENs are usually provided through high-speed backbone connections and higher-level services such as internet roaming within universities and identity federation.[42]

- **Research Cloud** is either a national research cloud (NRC) or an individual research cloud for the institution. It contains tools and services that provide access to high-performance computing resources in the form of fair access if it is an NRC or dedicated access in the case of an institutional research cloud.

2.2.3. Administration

The following are the critical digital services for administrative processes in higher education:

- **Financials** enables the university to prepare capital and operating budgets, allocate and track expenses, generate billings, capture payments, generate financial statements, and report cash flows and revenues.

- **Procurement** allows community members to acquire materials, assets, and services through a procure-to-pay (P2P) process, which facilitates order management and goods and services delivery. Purchase requisitions and purchase orders go through an approval workflow engine for controlling and meeting budget requirements. It is also a repository of the records of approved vendors and a catalog of goods and services.

- **Facilities** is a module that handles logistics, maintenance, repair, and operations, such as housing, janitorial services, utilities, buildings, and plant fixtures. This digital service helps maintain a healthy environment and safety standards.

- **Enterprise Assets** is a digital service for tracking, monitoring, and maintaining capital assets. Assets vary from tangible to abstract assets, such as software and licenses. The assets are captured, tagged, linked to specific locations, and possibly assigned to faculty members, staff, or students. This digital

[42] NRENs' identity federations provide a secure and privacy-preserving trust fabric for research and education institutions and their service providers.

service helps engineers secure assets in their best condition and performance possible through preventive and corrective maintenance plans. The tool enables the community to report failures and request maintenance services electronically.

- **Scholarship and Financial Aid** handles the financial and scholarship aid applications of students requesting financial assistance in settling their higher education expenses. The records can be filtered based on the potential candidates' academic standing or capacity to pay or other criteria set by donors and sponsors.

- **Grants** is a digital service that manages the financial gifts or grants donated by various sponsoring parties to students, faculty, and researchers. Grants are handled, monitored, and spent based on agreed-upon purposes and restrictions.

- **Contracts** is a digital service used by different users, such as procurement officers or grant officers, that centralizes the storage and management of the contracts of approved suppliers, contractors, and funding agencies. These contracts are recorded, managed, and audited regularly.

- **Human Capital** is a digital service for planning and managing human resources (HR) requirements. It classifies workers as employees, casual workers, and contractors. The scope of this service includes employee contracts, continual appraisal, grading system, and career paths. It serves as a single repository of all workforce information.

- **Talent Management** is used to measure the skills and abilities of employees and students based on their tasks and the responsibilities assigned to them. This will help identify talented individuals in the higher education sector.

- **Payroll** is integrated with the human capital digital service to generate pay slips for faculty and staff. The service ensures that everyone is paid on time subject to user-defined payment rules, methods, and currencies.

- **Materials and Inventory** is a module for managing goods, spare parts, and consumables used within the organization. The services allow community users to request items through the procurement digital service. Standard inventory procedures are implemented, such as regular inventory of slow and fast-moving items and ABC analysis to ensure efficient operations.

- **Marketing** enables recruiters to search for recruiting opportunities and decide on possible candidates and applicants. Marketing professionals are responsible for national and international outreach campaigns to present academic programs and promote the HEI's brand and image. The service must integrate with social and digital media channels.

- **Bookstore** is a digital service where students access printed or electronic books, materials, and products required in their studies.

2.2.4. Life

The following are the critical digital services related to university life:

- **Healthcare** is a digital service that enables HEIs to manage the health insurance coverage and electronic health records (EHR) of students, faculty, and staff. The EHR can be accessed only by authorized staff and is integrated via the interoperability platform with other national or private healthcare systems.

- **Mental Health** is a digital service that enables community members to get connected, avail of

psychological counseling, and care for their mental health. Licensed psychologists, mental health professionals, life coaches, and domain experts guide and monitor these mental health activities.

- **Device Management** is a service for facilitating the management of organizational devices and personal devices. Management includes standardizing software configuration for organizational devices and specific configuration and access settings for all other devices—including personal devices—that connect to the HEI network.

- **Security and Protection** is a digital service that offers the security team more control of physical access to the campus, buildings, and facilities, e.g., giving access to critical laboratories only to authorized faculty, staff, and students. Digital technologies, such as face recognition and biometric data, e.g., fingerprint and retina scans, can be deployed for a better and more secure environment.

- **Access Management** is a digital service that closely integrates with identity management to identify persons and grant appropriate access to various platforms and digital services where single sign-on authentication is utilized for a better and seamless experience. It enhances the security standards of an institution by allowing administrators to automate numerous user related tasks, manage identities, authenticate and authorize tasks.

- **Food and Beverage** is a digital service that acts as an e-commerce platform integrated with digital payment services for the community to book meals, shop for food, and request delivery services. This digital service can also include capabilities for managing food preparation and recipes, quality, and safety based on ISO 22000 standard.

- **Placement and Careers** is a digital service that offers a one-stop shop for senior students and alumni seeking post-graduation employment opportunities in various markets and industries. It usually provides a moderated portal for employers to post jobs and for the HEI to manage the hiring process of graduating students and alumni. This vital service impacts university rankings positively, especially in the employability category.

2.2.5. Common Services

The following are some of the common digital services used in academia, administration, and research in higher education institutions:

- **Content Management** is an enterprise application that manages any type of content in the organization and provides the required tools to digitize that content, set the appropriate access rights, and make the content available on the web, through portals or websites, or other applications via SEO-FURLs (search engine optimization-friendly uniform resource locators.

- **Document Management** is a vertical service, built on top of content management services, that provides the requisite features for managing documents. It is a mechanism for defining document libraries, types, and approvals. For academic stakeholders, it typically provides a storage folder for each student's admission records, transcripts, and other documents. For the research community, it provides the needed components to search, extract, edit, and view documents. Finally, for the administrative staff, it provides storage folders for procurement, human capital, and all other administrative services.

- **Correspondence Management** is a vertical service, built on top of document management services, that provides the features required for managing internal and external correspondence. It gives the needed profile for a correspondence (metadata) and the hierarchy of storage for correspondences, plus the labeling and retrieval of correspondence.

- **Knowledge Management** is a service that provides collaboration spaces aimed at retaining knowledge generated in different areas of the institution. It has a customizable storage for general documentation, experiments, findings, inventions, standard operating procedures, and Wikis.

- **Project Management** is a standard service for managing projects, leading teams with specific skills and knowledge, and working on tasks to achieve goals and desired outcomes. This digital service can be used in all domains of higher education.

- **Issue Tracking** is a common service for tracking issues, incidents, and problems. Multiple parties can use it, such as the IT help desk to track technical issues and resolve tickets; facilities department to track physical plant requests; and academic departments to track student issues and requests.

- **Web Conferencing** provides virtual spaces for meetings and webinars. This service usually provides advanced features for meetings and conferences such as spotlight, breakout sessions, and personalized presence.

- **Presence** is a set of features for providing information about the virtual presence of individuals. This service is typically integrated with an IoT (Internet of Things) platform, web conferencing tools, email, calendar, and other collaboration tools to provide the accurate virtual presence status of an individual.

- **Electronic Mail** facilitates communication among community members. This digital service includes calendars, tasks, to-do items, notes, and other functionalities.

- **Collaboration Workspaces** is a set of tools that facilitates collaboration among community members. Capabilities of this digital service include workgroup channels, shared tasks, virtual meetings, audio calls and messages, and document sharing.

- **Digital Assessments** are administered on digital devices and are designed to assess students and their achievement, knowledge, and skills at any given time. Micro-assessments use dynamic and innovative XR (extended reality) and AI technologies to provide frequent and engaging assessments that take only a few minutes to complete. Such services may be used for centralized national exams, self-service evaluation of curricula, and other purposes.

- **Licensures and Certifications** are often required for some professions in the health, engineering, legal, and accounting fields. Licensures consist of an assessment process based on preset criteria for obtaining a permit to practice a profession in a specific field or geographic area. Certifications, on the other hand, are more focused on the continuing education of professionals.

- **Governance, Risk, and Compliance (GRC)** is a system for directing and controlling the performance of functions of institutions and entities in the higher education sector. These capabilities enable the sectoral actors to mitigate risks, address uncertainties, achieve objectives, and safeguard institutional integrity. Implementing the GRC processes and technology across organizations reduces costs, eliminates duplication of work, improves information quality, and increases the efficiency to consistently perform functions and procedures.

- **Extended Relationship Management (xRM)** is a set of digital services that helps HEIs manage its relationship with key stakeholder groups, e.g., prospective students, current students, alumni, donors, sponsors, and employers. It is used to capture, manage, and nurture leads until they become students, and follow them throughout their journey after graduation and on to becoming alumni. Moreover, it helps manage alumni affairs and partnership development.

2.2.6. Shared Components

The following are the shared components that are used by the common services as well as the academic, administrative, and research IT systems in higher education:

- **Roles and Privileges** is a shared repository for defining roles and privileges and assigning them to individuals in the organization. It ensures that the system is implemented consistently across the entire digital services architecture.

- **Workflow Engine** is a tool for automating procedures and business processes. This engine enables authors to define the schema of a specific process, set approval levels, set task owners, design approval forms, specify workflow actions, and create scheduled and automated tasks.

- **Publishing Engine** is a digital repository for document generation and management and is used for creating public documents, such as policies, procedures, and announcements, in a user-friendly format. It also enables tracking and confirming the received-accepted-read receipt of these documents. For example, the HEI may want to have proof that all staff have read and accepted the code of conduct in compliance with regulations on general data protection and educational rights and privacy.

- **Notifications Engine** is a central engine for sending different types of notifications to end-users, such as emails, SMS (short messaging service), and push notifications. This engine supports a guaranteed delivery by setting up queues and retries, thus enabling administrators to define templates for notifications so that other platforms can conveniently generate and send readable and relevant messages.

- **Rules Engine** is a central component for defining the rules used by other platforms, workflow process, or conditional actions and computations. This engine must seamlessly integrate with other systems through a set of flexible APIs (application programming interface), web services, and support for standards such as the Business Process Model and Notation (BPMN) and Case Management Model and Notation (CMMN).

- **Digital Signature** is a trusted signature authority system that community members use to digitally sign their emails, documents, correspondence, and workflows.

- **Digital Payment** is a service integrated with a flexible and mature payment processing gateway for collecting application and admission fees, tuition fees, and other types of fees, including event seats. Digital payment may also be used in settling supplier invoices and reimbursing researchers, faculty, and staff for approved expenses. Combined with digital signature, this service can reduce collection cycle time.

- **IoT Platform** is a critical component in a smart campus. An IoT connectivity platform is designed to streamline the use of campus resources, e.g., buildings, utilities, rooms, spaces, libraries, and equipment. This platform can be used to control the use of energy, air quality, and campus spaces; and it can also be used to manage the attendance or presence of individuals in specific events and spaces.

- **Artificial Intelligence** plays a vital role in multiple areas of teaching and research, and other non-academic areas such as security. In teaching, AI has significant applications in identifying students who struggle in academic and social situations, thus aiding in early interventions to avoid dropouts and failures. Also, in the teaching process itself, AI supports adaptive learning by replacing the one-size-fits-all approach with the delivery of a customized learning experience that meets students' individual needs. This is achieved by using just-in-time feedback and pathways. In research, the application of

AI is enormous, as it can support automation of research techniques from generating a hypothesis and literature review to conducting experiments

- **Chatbots** may be used across various digital services and platforms. They may be used in marketing pages to help prospective students in their application process. Chatbots help students and staff get answers to their questions, thus reducing the workload of IT help desks and call centers. AI-powered chatbots may also be used in tutoring students.

- **Blockchain** provides an immutable trusted general ledger used for storing official documents, such as degrees, diplomas, certificates, and transcripts of records. The blockchain can be the next generation trust system for preventing fraud in the use of official university credentials. In research, the blockchain can be used to store significant research findings, authorship, copyright, and intellectual property ownership information.

- **Experiential Reality** may be applied in different aspects of teaching. The immersive experience provided by experiential reality tools is revolutionizing industries, and higher education is not an exception. It could be used to either provide better remote virtual learning or offer in-classroom students with multisensory experiences, such as simulating a hospital's operating room, an archeological exploration, aerospace, and astronomy; and navigating through digital signals.

- **Geo Tracking** is used for tracking campus security vehicles, shuttles, and other vehicles. Fleet management solutions use this technology heavily to streamline the tracking of movables. Moreover, it can be used for attendance tracking by installing a local application in the university where students in the classroom confirm their attendance and the application detects their location.

- **Multimedia Authoring** is a set of media authoring tools used for research promotion and dissemination, university communications and marketing, and, very importantly, development of reusable learning objects offered in online or hybrid courses. Using them requires appropriate technical support and training.

- **Social Media** use in a university should be streamlined to direct traffic to appropriate destinations. In addition to raising awareness, promoting university achievements, and showcasing research and projects, social media can be used in conjunction with AI-powered chatbots for recruitment and fundraising.

2.2.7. Portals

Portals are a set of web gateways that provide personalized services to university communities. Portals host electronic services, calendars, task lists, discussion forums, information pages and document libraries. They provide on-demand access to information with embedded security that ensures that data are delivered only to authorized users.

One essential portal is the Student Portal that provides a one-stop-shop for students and alumni to view relevant information, apply for specific services, and collaborate with other students and alumni. This portal is accessible to students from the time they apply for admission all the way to their becoming alumni. Services in this portal typically include (depending on the logged-in person status) class schedule, calendar and events, announcements and news, application status, requests status, tasks, support, other relevant resources, in addition to links to the LMS, library systems, specific applications, storage folders, and email.

2.2.8. Identity Platform

To enable innovation and transformation in teaching, learning, and research, a robust identity and access management (IAM) platform must be set up that will allow secure and authorized access to information. The identity platform categorizes users into students, alumni, staff, and faculty using a federated identification that enables collaboration with other universities, single sign-on features, user authentication, and other features. This identity platform is usually linked through a national identification system to various systems managing other services, such as healthcare, social security, and financials.

2.2.9. Data Platforms

Data platforms are vital in ensuring scalable and interoperable technologies that will meet the data requirements of HEIs and various actors in the higher education sector. Data platforms provide data classification, data warehousing, trend analysis, and extraction/transformation/loading tools.

2.2.10. Interoperability Platform

The interoperability platform provides the required tools and services that will enable different applications to communicate. It provides the management tools for interoperability, such as traffic controllers; service bus; API (application programming interface) services; adapters; and message queues to ensure that a message is received, queued, transformed, and delivered in the correct format from one application to another.

2.2.11. Performance Platform

- **Data Warehouse** is a multi-dimensional space for storing analytical data that are ready for reporting. Transactional data are used in day-to-day operations. In contrast, analytical data are considered time-stamped snapshots of transactional data that are available for fast access and reporting.
- **Business Intelligence** is a set of tools that provides interactive ways of visualizing data that come from databases, data warehouses, or external services.
- **Educational Indicators** are statistical analyses that compute and describe important aspects of higher education. They are used in assessing quality, interpreting performance, and identifying issues.
- **Reports** are documents that can be easily customized to user requirements without the need for programmer intervention. They are vital outputs that actors in the higher education sector use frequently.

2.3. Information Security

Information is an asset that requires appropriate protection against the loss of availability, confidentiality, and integrity. Enabling the timely availability of accurate and complete information to those with authorized access is a catalyst for institutional efficiency. Information security must be embedded into all applications as the first line of defense. To achieve such level of protection, all actors in the higher education sector must adopt a security-by-default approach, whereby the security controls embedded in every digital service are set at the highest levels of protection. One of the hallmarks of being more proactive in securing data is that protection is the default posture. In other words, the information security management system (ISMS) should be secure-by-design.

2.3.1. Information Security Management System

Organizations can use standards to create and apply a framework for managing the security of their information assets. These include financial information, intellectual property, student records, employee information, and information given to them by other stakeholders or third parties. Following ISO Standard 27001, any organization can establish, implement, manage, and continuously improve an ISMS. Organizational structure, policies, planning activities, responsibilities, practices, procedures, processes, and resources are all part of ISMS. Information security entails implementing and monitoring suitable security measures to address a wide range of risks to ensure long-term business success and continuity while reducing the impact of information security.

2.3.2. Cybersecurity

Confidence in cybersecurity measures and transparency in the use of personal information are vital in gaining the trust of stakeholders and encouraging them to transact online. Cybersecurity presents a significant challenge for the higher education sector. In the Philippines, the Department of ICT (DICT) is in charge of implementing the general rules on the protection of information systems and network security. It is highly recommended for DICT to take the lead on behalf of the higher education sector to work with other national agencies and entities involved in defining and implementing the National Cybersecurity Plan, as it is nearly impossible to take a sectoral approach to this complex endeavor. For the higher education sector, the DICT can define a cybersecurity policy that will support the plan. In addition, HEIs should independently establish information technology and information security units with sufficient staff, qualifications, and job responsibilities.

2.3.3. Data Protection and Privacy

Data privacy is not achievable without data protection, and one cannot have data protection without information security. Digital transformation projects create new risks as technology implementers must deal with personal data, classification, protection, and data security. Data protection and privacy laws give individuals the right to access personal data concerning them and modify or delete them as necessary. These laws also permit individuals to object to the processing of personal data concerning them for legitimate reasons, except where the processing is planned by law or is required by the nature of the obligation. Individuals can also object to their personal data being shared with third parties for advertising purposes.

2.3.4. Information Security Risk Management

Information security is achieved by implementing an applicable set of controls, selected through a risk management process and managed using an information security management system. The ISMS manages policies, processes, procedures, organizational structures, software, and hardware to protect the identified information assets. On the other hand, ISO Standard 27005 for information security risk management (ISRM) is used for assessing, mitigating, and managing information risks, including (i) risk identification, (ii) risk analysis and evaluation, (iii) risk treatment and acceptance, and (iv) risk monitoring. These controls are specified, implemented, monitored, reviewed, and improved, where necessary, to ensure that the specific information security and business objectives of the actors in the higher education sector are met.

2.3.5. Business Continuity Management System

Business continuity management (BCM) aims to protect the sector against threats such as natural disasters or data breaches. BCM includes disaster recovery, business recovery, crisis management, incident management, emergency management, and contingency planning. According to the ISO 22301 standard, a BCM system supports establishing business continuity management policies, objectives, operating controls, and measures for managing overall continuity risks. It also enables the sector to monitor and review the performance and effectiveness of the BCM system and supports continual improvement based on objective measurements.

All actors in the higher education sector need fault-tolerant systems and backup data storage so that sensitive information can survive an emergency. Planning for the continuity of operations involves developing individual processes and applications to that they can resume immediately after a crisis. A continuity of operations plan establishes the policy and guidance to ensure that in case of emergencies, critical functions continue while personnel and resources are relocated to an alternate facility. The sectoral and institutional continuity of an operations plan must consider the budgets required to maintain the services provided to stakeholders, including the required cost of operations for all data systems and information security systems, which keep those services operational.

A disaster recovery plan (DRP) guides the actions of emergency response personnel until the affected digital services are restored to full operating capacity in their primary operations facilities. A DRP is designed to reduce decision making activities during an emergency. It requires essential training of staff to familiarize them with their duties and responsibilities in the event of a disaster. Critical systems must be identified and prioritized to determine the necessary tasks and sequence of restoring the systems after a disaster or system failure.

Resilience and disaster recovery in digital transformation are generally seen as operating costs rather than value drivers, a misconception that must be corrected. Although organizations invest substantially on system availability, new digital technologies are considered drivers of value, while resilience and disaster recovery are viewed as expenses rather than investments. However, meeting operational key performance indicators and preventing technology disruptions are very closely linked. It is essential to consider how other areas, such as resilience, must be strengthened when undergoing a digital transformation. Poor resilience means that all the benefits of new technology could be undone because of the high costs of recovery, damage to reputation, loss of revenue, and loss of data.

Vision and Strategic Goals

CHAPTER 3

Vision and Strategic Goals

This report presents an option for developing strategic goals and actions as CHED charts the country's digital transformation strategy for Philippine higher education. The goals and actions are envisioned to contribute to the transformation of Philippine higher education into an effective, equitable, accountable, competitive, and innovative system—standards that are consistent with *CHED's Medium-Term Strategic Plan for the Higher Education Sector 2022-2028*, whose mission is "to promote equitable access to higher education, ensure quality of programs, and assert the relevance of higher education institutions" (CHED 2022a).

There are four areas that CHED may consider in developing its digital transformation strategy: (i) equity; (ii) quality and relevance; (iii) efficiency; and (iv) innovation and competitiveness. Digital transformation is expected to play a vital role in the implementation of the strategy. Hence, it is critical that the digital transformation vision, strategic goals, and actions are well integrated into the overall strategic plan of CHED in such a way that digital technology can contribute to achieving the overall sectoral strategic goals and objectives. Aligned with CHED's mission and overall strategic goals, this report recommends the following pathways of action that CHED may consider in its vision for digital transformation: (i) provide equitable and inclusive access to learning; (ii) improve the quality and relevance of education in enhancing student learning and employability; (iii) strengthen governance and management capacity; and (iv) foster research and innovation to make Philippine higher education globally competitive and socially responsible.

There are two levels where CHED can optimize opportunities for advancing digital transformation strategic goals and actions: (i) At the system level, for CHED, together with other key stakeholders, to build a modernized higher education sector and contribute to the country's economic and social development; and (ii) At the institutional level, for HEIs—both public and private—to improve their service delivery. These strategic goals and priority actions are based on an in-depth situation analysis of the higher education sector and country context, as discussed in Chapter 1; as well as the foundations of digital transformation, as discussed in Chapter 2, including the Governance (Annex 8) and the Pillars (Annex 9) of digital transformation. While the key players for these goals and actions are CHED and HEIs, the successful implementation of the strategy requires multisectoral support from central government agencies such as the National Economic and Development Authority (NEDA) and Department of Information and Communications Technology (DICT), as well as the private sector. At the institutional level, the strategy could be adjusted according to each institution's needs and priorities. The support and engagement of faculty members, students, and local communities, including the labor market, is also crucial. Table 5 illustrates the alignment of the overall strategic plan, system-level goals, and institutional-level goals. The next sections discuss these goals and actions in detail.

Table 5. Alignment of the Strategic Goals of the Digital Transformation of Philippine Higher Education with CHED Strategic Plan 2022-2028

GOAL AREAS	CHED STRATEGIC PLAN 2022-2028	DIGITAL TRANSFORMATION OF PHILIPPINE HIGHER EDUCATION	
		SYSTEM LEVEL GOALS	INSTITUTIONAL LEVEL GOALS
G1: Equity	SG 1: Reinforcing Equitable and Inclusive Access to Quality Higher Education	G1: Enhance equitable access to higher education.	G1: Support digitally disadvantaged students.
G2: Quality and Relevance	SG 2: Sustaining Quality and Excellence in Higher Education Institutions	G2: Strengthen the higher education quality assurance system.	G2a: Effectively adopt digital technologies to improve the quality and relevance of teaching and learning. G2b: Revise the curricula and programs for basic digital skills as well as advanced digital technologies. G2c: Establish micro-credentials for digital skills that are in high demand in the labor market.
G3: Efficiency	SG 4: Strengthening Social Responsibility of Higher Education Institutions	G3: Boost the efficiency and effectiveness of CHED's supervisory functions and social responsibility.	G3: Strengthen administration and management capacities to provide efficient services.
G4: Innovation and Competitive-ness	SG 3: Advancing Internationalization of Philippine Higher Education SG 5: Increasing the Resiliency and Innovation of CHED	G4: Develop digital infrastructure where universities collaborate and share advanced digital technologies.	G4: Enhance university-industry collaboration in research and innovation.

Source: CHED 2022a for CHED Strategic Plan 2022-2028.

3.1. Strategic Goals and Actions at the System Level

CHED, together with other key government agencies such as National Economic and Development Authority (NEDA), Department of Information and Communications Technology (DICT), Technical Education and Skills Development Authority (TESDA), Department of Education (DepEd), and Department of Budget and Management (DBM), should promote the creation of a conducive policy environment to support the development of sufficient physical and human capacities needed for the digital transformation of higher education. The system level strategic goals may include: (i) ***G1: Equity.*** Enhance equitable and inclusive access to higher education; (ii) ***G2: Quality and Relevance.*** Strengthen the quality assurance system; (iii) ***G3: Efficiency.*** Boost the efficiency and effectiveness of CHED's supervisory functions and social responsibility; and (iv) ***G4: Innovation and Competitiveness.*** Develop digital infrastructure where universities collaborate and share advanced digital technologies. Table 6 describes the recommended actions to achieve these goals. Also in the table are the relevant sections in this report where those actions are described and the entities responsible.

Table 6. System Level Strategic Goals and Actions

SYSTEM LEVEL GOALS	ACTIONS	TIME-LINE	RELEVANT SECTIONS	KEY ACTORS
G1: Equity. Enhance equitable and inclusive access to higher education.	**Action 1:** Invest in digital infrastructure and technologies in underserved areas and reach disadvantaged students.	YR1-6	1.2.1	National government (NEDA, DICT, DBM, CHED), LGUs
G2: Quality and Relevance. Strengthen the quality assurance system.	**Action 2:** Develop a digital competency framework for higher education actors.	YR1-2	Context 1.2.1 1.3.1	CHED, TESDA, DepEd, NEDA, DICT, leading HEIs, industries, professional associations Accreditation agencies, PRC, and industries
	Action 3: Develop minimum standards and guidelines on digital education and MOOCs.	YR1-2		
	Action 4: Analyze and provide information on the demand for digital skills.	YR1-6		
G3: Efficiency. Boost the efficiency and effectiveness of CHED's supervisory functions and social responsibility.	**Action 5:** Revise or develop policies, standards and guidelines that support the monitoring and evaluation of successful online learning, expand online education platforms, enhance the interoperability of higher education operations and management tools, and strengthen cybersecurity and data privacy.	YR1-2	1.2.2 1.3.3 1.1.3 1.2.1 1.1.4	CHED, DICT, NEDA, DBM CHED and private sector CHED, accreditation agencies
	Action 6: Mobilize private funding and public-private partnerships to invest in new education technologies for the higher education sector.	YR3-6		
	Action 7: Initiate a system-wide platform to enhance the quality assurance system.	YR3-6		
G4: Innovation and Competitiveness. Develop digital infrastructure where universities collaborate and share advanced digital technologies.	**Action 8:** Expand the existing NREN-equivalent (i.e., PREGINET) for HEIs and research institutions.	YR2-4	1.2.1 1.1.2	National government (NEDA, DICT, DBM, CHED)
	Action 9: Establish a research team to support the use of education technology for teaching and learning.	YR3-6		

Source: Authors

G1: Equity. Enhance equitable and inclusive access to higher education

Action 1. Invest in digital infrastructure and technologies in underserved areas and reach disadvantaged students

The pandemic widened the digital divide. To provide better digital access to higher education for digitally disadvantaged students (including ethnic minorities, Indigenous Peoples, and students with disabilities), faculty members, and HEIs, CHED can work with other national government agencies, local governments, and the private sector to invest in digital infrastructure in underserved areas. CHED should define the criteria and verification mechanism for the identification of digitally disadvantaged students and agree with HEIs on a minimum package of support for them, such as financial support and subsidized access to internet, devices, and cloud computing platforms. To benefit from economies of scale, CHED could explore sector-wide joint procurement approaches and opportunities for connectivity, devices, services, content, and journal subscriptions, including coordination across private and public HEIs at the provincial level. CHED, in collaboration with DICT (e.g., for the preparation of bidding documents and technical specifications), can support for HEIs and explore an introduction of multi-year framework contracts for the provision of broadband internet services to HEIs at the local level. This would create incentives for internet service providers to operate in underserved provinces and population centers. CHED can also explore with other government agencies the feasibility of support for improved connectivity in the higher education sector through a targeted mechanism (such as a Universal Service Fund) by which a national telecom regulatory authority mandates, oversees, and coordinates a set of subsidies and fees designed to promote access to telecommunication services for underserved segments of the population (ITU 2013).[43]

G2: Quality and Relevance. Strengthen the quality assurance system.

Action 2. Develop a digital competency framework for higher education actors.

All Filipinos need to acquire digital skills that are increasingly required for success in daily life and the labor market—from basic digital literacy to the use of advanced digital technologies. For this, the country needs a comprehensive digital competence framework covering different proficiency levels, namely, basic, intermediate, advanced, and highly specialized. This task can be led by DICT. As part of the comprehensive framework, CHED, together with TESDA, DepEd, NEDA, leading HEIs, relevant industries, and professional associations, can contribute to the development of a digital competency framework and digital competency self-assessment tools for advanced and highly specialized levels. Such tools can guide higher education actors—teachers, students, administrators, and IT staff to develop relevant programs.

Action 3. Develop minimum standards and guidelines on digital education and MOOCs.

CHED, together with TESDA, leading HEIs, relevant industries and professional associations, should develop minimum standards and guidelines on digital education and massive open online courses (MOOCs), including: (i) basic digital skills to be offered in all programs and advanced digital skills to be offered in digital technology programs (e.g., online or offline, hours, knowledge and skills, practicum vs. theoretical, internships, and assessment); and (ii) the use of technology in online learning (e.g., student identity verification in online education, web and learning content accessibility, and online course credit registration). In addition, CHED, together with the aforementioned stakeholders, will develop standards and guidelines for micro-credentials for specific digital skills that are in high demand in the labor market. CHED will need to monitor that the standards and guidelines are implemented by the accreditation agencies in a harmonized and transparent manner. CHED should also strengthen the core indicators for the "use of ICT and learning resources" in the Institutional Sustainability Assessment Self-Evaluation Document (ISA-SED) to ensure high quality of monitoring.

[43] ITU 2013. "Universal Service Fund and Digital Inclusion for All." https://www.itu.int/en/ITU-D/Regulatory-Market/Documents/USF_final-en.pdf.

Action 4. Analyze and provide information on the demand for digital skills.

CHED, in collaboration with DICT, DTI, DOST, and NEDA, should regularly assess labor market demand for digital skills. As part of the development of this report, innovative methods using data science and AI were adopted to analyze digital skills gaps and curriculum alignment to respond to the labor market demand for digital skills. CHED may consider expanding such analyses to improve curriculum standards and provide up-to-date information on labor market demand for digital skills. CHED can also coordinate with DICT in implementing the Digital Workforce Survey, which DICT is developing to assess the skills required for a digitally enabled workforce in the Philippines. Similarly, CHED can contribute to DTI's Philippines Skills Framework Initiative in identifying and filling the digital skills gap.

G3: Efficiency. Boost the efficiency and effectiveness of CHED's supervisory functions.

Action 5. Revise or develop policies, standards and guidelines that support the monitoring and evaluation of successful online learning, expand online education platforms, enhance the interoperability of higher education operations and management tools, and strengthen cybersecurity and data privacy.

Prior to the pandemic, the Open Distance Learning Act of 2014 institutionalized open distance learning in tertiary education. As a response to the demand for more flexible modes of learning during the pandemic, CHED developed the guidelines for flexible learning and launched PHL CHED Connect—a platform for open educational resources. CHED could expand this platform to curate resources from local and international HEIs and online course agencies supported by a screening mechanism to ensure the quality of courses to be curated. In light of the rapidly changing environment surrounding the need for open learning, it would be important that CHED further strengthen the regulatory framework for the implementation of online learning. This would include policies on student identity verification in online education, web and learning content accessibility, and online course credit registration (e.g., in MOOCs). CHED may also enhance the higher education platform by integrating the databases of CHED, higher education associations, and HEIs' learning management systems; and enhancing the interoperability of data, such as student information and credit transfers. The enhanced online education platform and tool should be designed following cybersecurity and data privacy regulations and in coordination with DICT and the National Privacy Commission.

Action 6: Mobilize private funding and public-private partnerships to invest in new education technologies for the higher education sector.

As public funding is limited, it would be essential to mobilize private funding to invest in new education technologies. CHED, together with NEDA, DBM, DICT, and DTI could explore potential means for public-private partnerships, for instance, by providing matching funds to private investments for a university-industry collaboration hub in select regional state universities and colleges and local universities and colleges. CHED would need to strengthen its own capacity to advise HEIs on technical specifications for equipment and management of outsourcing arrangements and contracts. CHED can support HEIs in contributing to the development of local communities as part of their social responsibility.

Action 7: Initiate a system-wide platform to enhance the quality assurance system.

While CHED introduced the Institutional Sustainability Assessment to help improve the internal quality assurance processes at the institutional level, the external quality assurance is limited because institutional and program accreditations are voluntary. Even though CHED's mandate does not include accreditation per se, CHED has the power and function to "monitor and evaluate performance of programs and institutions of higher learning for appropriate incentives as well as the impositions of sanctions such as, but not limited, to diminution or withdrawal of subsidy, recommendation on the downgrading or withdrawal of accreditation, program termination or school closure" (Section 8 (e) of RA 7722). To enhance the overall quality assurance system, CHED should initiate a system-wide discussion on strengthening the quality assurance system for the entire higher education sector, covering public and private institutions.

G4: Innovation and Competitiveness. Develop digital infrastructure where universities collaborate and share advanced digital technologies.

Action 8. Expand the existing NREN-equivalent (i.e., PREGINET) for HEIs and research institutions.

The Department of Science and Technology's Advanced Science and Technology Institute (DOST-ASTI) manages the Philippine Research, Education, and Government Information Network (PREGINET)—a specialized internet service provider dedicated to supporting the needs of research and education communities. However, only the top research-oriented HEIs participate in PREGINET. Moreover, CHED is not a PREGINET government partner. There are the Philippine Higher Education Research Network and Higher Education Regional Research Centers, but they do not have a dedicated digital platform and have not been active. Together with DOST-ASTI, CHED could explore opportunities for increasing the participation of CHED and HEIs in PREGINET or establish a new NREN where all HEIs and research partners can participate. An enhanced or new REN can provide such services as: (i) authentication and authorization infrastructure; (ii) high performance computing (HPC); (iii) collective access to international digital research databases; and (iv) local collective research database. To ensure fair access and use, it is essential that CHED formulate policies so that the enhanced or new REN will be used only for authorized activities and the bandwidth is fairly distributed among institutions. This should be complemented by a policy that sets the warnings, escalation and termination of use by individuals who abuse the network. In addition, access to eduroam (education roaming) could be expanded to more HEIs to provide network access to researchers, teachers, and students when visiting an institution other than their own. The eduroam is an international Wi-Fi internet access roaming service used in research, higher education, and further education.

Action 9. Establish a research team to support the use of education technology for teaching and learning.

There is no education sector-wide body that comprehensively supports the adoption of education technology at all levels of education. CHED, together with DepEd and TESDA, could explore the establishment of a National Education Technology Forum[44] where education stakeholders can freely exchange ideas on the use of technology to enhance learning, assessment, planning, and administration at all levels of education and to share the latest knowledge and best practices to facilitate decision making related to the adaptation of education technology.

3.2. Strategic Goals and Actions at the Institutional Level

Institutions have gradually adopted a wide range of digital services, systems, and infrastructure, but often without a clear strategy to become a fully digitally transformed HEI. Lack of proper planning and limited understanding of existing digital solutions are a challenge and can negatively impact digital transformation. One example is poor coordination between the IT leadership and departments that are focused on increasing the number of devices and network strength on the one hand, and on the other, the administration and faculty that are focused on student outcomes. Thorough planning and coordination between management and various departments will help institutions avoid these issues.

At the institutional level, it is essential that senior leaders play a major role in working across the organization—from the administration to the faculty and the IT leadership—so that everyone has a shared understanding of problems and opportunities that require digital solutions. The institutional level strategic goals could include: (i) ***G1: Equity.*** Support digitally disadvantaged students; (ii) ***G2a: Quality and Relevance.*** Effectively adopt digital technologies to improve the quality and relevance of teaching and learning; ***G2b:*** Revise the curriculum and programs for basic digital skills as well as advanced digital

[44] An example is the one proposed in India. https://www.education.gov.in/sites/upload_files/mhrd/files/upload_document/NETF.pdf.

technologies; and ***G2c:*** Establish micro-credentials for digital skills that are in high demand in the labor market; (iii) ***G3: Efficiency.*** Strengthen administration and management capacities to provide efficient services; and (iv) ***G4: Innovation and Competitiveness.*** Enhance university-industry collaboration in research and innovation. Table 7 summarizes the proposed actions to achieve the institutional level strategic goals. Each institution should set its own priorities and align these goals with its mission, vision, and strategic goals. These goals and actions are applicable to both public and private HEIs.

Table 7. Institutional Level Strategic Goals and Actions

GOALS	ACTIONS	TIME-LINE
G1: Equity. Support digitally disadvantaged students.	**Action 1:** Provide support to disadvantaged students to ensure their access to digital learning resources.	YR1-3
G2a: Quality and relevance. Effectively adopt digital technologies to improve the quality and relevance of teaching and learning.	**Action 2:** Train academic faculty members and IT staff to use digital technologies effectively and provide them with the necessary technical and psychological support and guidance.	YR1-2
	Action 3: Provide tutorials to students on the effective use of technologies	YR1-2
	Action 4: Identify and adopt the appropriate digital technologies that fit the purpose of institutions and programs.	YR3-6
G2b: Quality and Relevance. Revise the curricula and programs for basic digital skills as well as advanced digital technologies.	**Action 5:** Provide all students regardless of specialization with basic digital knowledge and skills that are needed in today's economy and society.	YR1-3
	Action 6: Enhance the quality and relevance of programs for advanced digital technologies that are increasingly required by the labor market.	YR3-5
	Action 7: Use digital technology to adopt a data-driven approach in aligning the curricula and programs with job market requirements.	YR2-4
G2c: Quality and Relevance. Establish micro-credentials for digital skills that are in high demand in the labor market.	**Action 8:** Strengthen opportunities for lifelong learning and provide alternative credentials such as digital badges and micro-credentials.	YR3-6
	Action 9: Incorporate available MOOCs into university programs and provide course credits and micro-credentials, as appropriate.	YR1-3
G3: Efficiency. Strengthen administration and management capacities to provide efficient services.	**Action 10:** Adopt digital tools to manage administrative and academic data and enhance the interoperability of management systems within each HEI and across HEIs, wherever appropriate.	YR2-4
	Action 11: Enhance human resources management and pool human, financial, and physical resources to minimize redundancy and costs.	YR1-3
	Action 12: Standardize equipment, tools, and systems and consolidate investments and procurement procedures, including vendor approval, to achieve economies of scale.	YR3-6
G4: Innovation and Competitiveness. Enhance university-industry collaboration in research and innovation.	**Action 13:** Invest in institution-specific digital technologies related to research, such as research clouds and research tools.	YR3-6
	Action 14: Establish cooperative education, internship, and mentorship programs in collaboration with local and national industries.	YR3-6

Source: Authors

G1: Equity. *Support* digitally disadvantaged students.

Action 1: Provide support to disadvantaged students to ensure their access to digital learning resources.

The pandemic widened the digital divide not only between HEIs but also within HEIs. Many students do not have access to a stable internet, gadgets, and a conducive learning environment at home. As the magnitude of digital divide differs among HEIs, each HEI needs to develop its own schemes to support disadvantaged students so that they have equal and inclusive access to digital learning, e.g., free use of the university's intranet, rental of gadgets, downloadable learning materials, and support to students with disabilities and Indigenous Peoples.

G2a: Quality and Relevance. *Effectively adopt digital technologies to improve the quality and relevance of teaching and learning.*

Action 2: Train academic faculty and IT staff to use digital technologies effectively.

The majority of faculty members were not prepared for the sudden shift to remote learning. They were forced to adopt new ways of delivering programs, but the learning curve was steep. IT staff, on the other hand, might not have been aware of the latest education technologies for remote learning. When HEIs shifted to online learning, many faculty members and IT staff had to work extra hours to prepare the digital setup, teaching approaches, assessment methods, and teaching and learning materials. HEIs need to provide targeted training programs so that faculty members can use digital technologies effectively in enhancing the quality and relevance of programs. IT staff should also be well trained to provide the needed know-how in solving IT issues and implementing IT processes. Moreover, it is important that the staff be given the necessary psychological support, taking into account their extra workload and the enormous challenge of adopting to significant changes at work.

Action 3: Provide tutorials to students on the effective use of technologies.

Students need to learn how to use various functions of new learning platforms such as learning management systems (LMS). HEIs may provide students with tutorials on how to use plug-ins or tools integrated with LMS, e.g., how to subscribe to groups, how to add reminders, how to structure assignment schedules, and how to take an online exam.

Action 4: Identify and adopt the appropriate digital technologies that fit the purpose of institutions and programs.

Each HEI has a distinct mission, vision and goals. Each serves different groups of students with varying needs. Some institutions have a strong link with local labor markets that demand medium-level digital skills, while others may cater to global labor markets that require high-level and advanced digital skills. Hence, each HEI should identify its digital technology requirements that are fit for the purpose of the institution and its programs as well as provide the appropriate skills to its students.

G2b: Quality and Relevance. *Revise the curricula and programs for basic digital skills as well as advanced digital technologies.*

Action 5: Provide all students regardless of specialization with basic digital knowledge and skills that are needed in today's economy and society.

Today, everyone experiences digital technologies in daily life and work. Thus, everyone needs to acquire

basic digital knowledge and skills to be able to use those technologies effectively. HEIs need to include basic digital knowledge and skills in all programs, regardless of discipline, in accordance with institutional and program accreditation requirements.

Action 6: Enhance the quality and relevance of programs for advanced digital technologies that are increasingly required by the labor market.

Digital technologies are rapidly developing. Digital skills required today may not be relevant in the future. Therefore, it is critical that HEIs are up-to-date on the latest digital technologies required in the rapidly changing labor market. In addition to specific digital skills, it is also important to teach soft skills such as flexibility, adaptability, and creativity in keeping pace with the changing work environment.

Action 7: Use digital technology to adopt a data-driven approach in aligning the curricula and programs with job market requirements.

HEIs can use advanced digital technologies to better align the content of the curriculum and programs with labor market demand. For instance, using artificial intelligence, HEIs can analyze high-demand skills within specific job titles, and this information can aid the development of more relevant curricula, syllabi, and course offerings. An analysis of students' work skills, experience, and education on the one hand, and the jobs and careers they aspire on the other, can help identify skills gaps.

G2c: Quality and Relevance. *Establish micro-credentials for digital skills that are in high demand in the labor market.*

Action 8: Strengthen opportunities for lifelong learning and provide alternative credentials such as digital badges and micro-credentials.

In addition to getting an undergraduate or graduate degree, there are other ways of developing the skills required by a rapidly changing labor market. Students may want to acquire specific skills as needed and when needed throughout their lifetime. Lifelong learning through reskilling and upskilling will give them a chance to adjust their skills. Demand for micro-credentials and digital badges is growing. HEIs should identify and develop those courses that are in high demand, and regularly review and update them.

Action 9: Incorporate available MOOCs into university programs and provide course credits and micro-credentials, as appropriate.

MOOCs for students are increasingly used in the Philippines to supplement the on-campus curriculum. HEIs do not necessarily need to develop programs from scratch if others already offer excellent programs. Instead, HEIs can effectively incorporate available MOOCs into their programs. To do so, HEIs should set standards and guidelines for adopting MOOCs, search high quality and relevant MOOCs, offer access to them through LMS, and assign the corresponding course credits and micro-credentials.

G3: Efficiency. *Strengthen administration and management capacities to provide efficient services.*

Action 10: Adopt digital tools to manage administrative and academic data and enhance the interoperability of management systems within each HEI and across HEIs, wherever appropriate.

Often, different players within an HEI develop their own digital databases with little coordination with each other, thus resulting in lack of interoperability. Data platforms are vital in ensuring scalable and interoperable technologies that serve the data needs of HEIs and various actors in the higher education sector. Higher education operations and management tools should be designed for students, researchers, educators, administrators, planners, and government agencies in the higher education sector so that they can access

and share information efficiently. A robust identity and access management platform should be set up to allow secure and authorized access to information.

Action 11: Enhance human resources management and pool human, financial, and physical resources to minimize redundancy and costs.

As the labor market demand changes rapidly, some faculty members have to update their skills to adapt to the changes. To manage human resources and maintain the skills level of the current faculty, upskilling and reskilling of their expertise are critical. Where the skills sets are not available internally, HEIs can bring in external human resources with the appropriate advanced technical skills.

Action 12: Standardize equipment, tools, and systems and consolidate investments and procurement procedures, including vendor approval, to achieve economies of scale.

Within an HEI, various departments often procure different new technologies that are not necessarily complementary. It is often not intentional, but rather a matter of efficiency. HEIs could develop standards to be regularly reviewed and updated to ensure the cross-platform compatibility and security of the new technologies that they acquire.

G4: Innovation and Competitiveness. Enhance university-industry collaboration in research and innovation.

Action 13: Invest in institution-specific digital technologies related to research, such as research clouds and research tools.

The needs of HEIs for digital technologies vary across institutions, and they are determined in part by opportunities for research collaboration with local industries. Some HEIs may need to build research clouds, which are portals for building virtual research workspaces. With research clouds, HPC can be shared between HEIs and industries and innovation projects can be developed collaboratively.

Action 14: Establish cooperative education, internship, and mentorship programs in collaboration with local and national industries.

The ultimate mission of HEIs is to educate students and equip them for a prosperous career ahead. Increasing the chances of new graduates' employability is aided by ensuring that they have the knowledge and practical skills that their future employers will require. Consequently, instituting cooperative education, internship, and mentorship programs in collaboration with local and national industries will positively affect local and national employment rates.

Annexes

Annexes

Annex 1: Types of Higher Education Institutions

Public HEIs

SUCs are HEIs created and financed by the national government. While SUCs are not owned by CHED, they are subject to most of the policies issued by CHED. In addition, a CHED Commissioner serves as the chairperson with one vote in major decisions for each institution's governing board. Some SUCs may have a satellite campus.

LUCs are established and subsidized by local government units, which may be a *barangay* (community), a municipality, a city, or a province. The Universal Access to Quality Tertiary Education Act has incentivized LUCs to adopt various policies issued by CHED.

OGSs are public secondary or post-secondary technical-vocational institutions that offer higher education courses.

CSIs are non-chartered, public post-secondary institutions under the direct supervision of CHED. CSIs are established by law and administered, supervised, and financially supported by the government.

Special HEIs are institutions that are directly affiliated with government agencies, e.g., Philippine National Policy Academy, Philippine Military Academy, Development Academy of the Philippines.

Private HEIs are categorized as autonomous, deregulated, and regulated. CHED periodically releases a CHED Memorandum Order (CMO) granting autonomous and deregulated status to select HEIs based on their evaluation. Normally, the status grant is valid for five years. However, due to changes in guidelines, the CMO No. 12, Series of 2019[45] granted those statuses valid for only two years through May 31, 2021. Subsequently, CMO No. 7, Series of 2021[46] extended the validity until May 31, 2023, by which 71 private HEIs were granted autonomous status, and 16 HEIs deregulated status (CHED 2021a). CMO No. 19, Series of 2016[47] states the benefits and responsibilities of autonomous and deregulated private HEIs, which includes offering alternative modes of education, Expanded Tertiary Education Equivalency and Accreditation Program (ETEEAP), or transnational education (CHED 2016).

Autonomous status is granted to private HEIs that have been evaluated to have exceptional institutional quality and enhancement through internal quality assurance systems, and that demonstrate excellent program outcomes.

Deregulated status is granted to HEIs that have been evaluated to have very good institutional quality and very good program outcomes.

Regulated status is granted to institutions that "still need to demonstrate good institutional quality and program outcomes" (CHED 2014, p. 17).

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45 https://ched.gov.ph/wp-content/uploads/CMO-12-s-2019-Grant-of-Autonomous-and-Deregulated-Status-to-Private-HEIs.pdf

46 https://ched.gov.ph/wp-content/uploads/CMO-No.-7-series-of-2021-Extension-of-the-Validity-Period-of-Autonomous-and-Deregulated-Status-Granted-to-Private-Higher-Education-Institutions-from-June-1-2021-to-May-31-2023.pdf

47 https://ched.gov.ph/wp-content/uploads/2018/03/CMO-19-series-of-2016-AD-Benefits-Official.pdf

Annex 2: Industry Employment Demand for 4th Industrial Revolution Skills

INDUSTRIES	POOLS OF ECONOMIC VALUE (US$)	IMPACT ON EMPLOYMENT (CURRENT AND PROJECTED)[48]
IT-BPM	$29.9 billion in 2020 $16.3 billion (contact center industry)	1.2 million workers 130,000 more jobs 30% of the workforce in "next wave" cities[49] 200,000+ graduates needed every year 150,000 shortfall every year
Agriculture, Forestry and Fisheries	$6.2 billion agriculture and food processed exports	10.8 million workers in 2021
Agribusiness	$1.8 billion food processing	1.1 million additional workers
Construction	$24 million $83 billion public-private investment $157 billion prefab building modules	4 million workers in 2021
Transport and Logistics (air, water, and mass rail transport)	$11 billion gross value added in 2020 84% from land transport and warehousing	2.8 million workers in 2021
Maritime	$6 billion remittance from sea-based workers in 2017[50] $915 million planned global maritime hub	500,000 additional professionals and graduates needed
Manufacturing - Electronics and Semiconductors, Aerospace and Automotive Industries	$45.92 billion revenues from exports of electronics in 2021 $52-112 billion by 2030 optimum business condition	14 million workers 24 million workers estimated under optimum business conditions
Banking and Finance		593,000 workers, 2021
Hotel, Restaurant and Tourism	$6.5 billion gross value added in 2019 $290 million medical tourism revenues in 2016 (Francisco et al. 2019)	4.7 million workers in 2020
Health and Wellness (Yeung & Johnston 2018)	$4.5 trillion global wellness economy $115.9 million wellness market, Philippines	1.4 million wellness workers
Education	$4.7 billion projected in 2024 (Statista 2021)	412,077 workers in 2018

[48] 2021 data, Philippine Statistics Authority, Labor Force Survey; Employment Projections, DTI, Philippines GVC Policy briefs, Philippine Dev Plan 2017-2022, updated.

[49] In 2018, DOST-ICTO and IBPAP identified Baguio, Cagayan de Oro, Dagupan, Dasmarinas, Dumaguete, Lipa, Malolos, Naga, Sta. Rosa, and Taytay as the 'next wave cities'. For IT-BPAP operations, Davao and Iloilo are locations for Centers for Excellence, https://www.bworldonline.com/features/2018/08/31/184547/new-beacons-of-opportunity-for-phls-it-bpm-industry/. 'Next wave cities' are now called 'digital cities,' which place Balanga City, Batangas City, Cabanatuan City, Dagupan City, and General Santos City among the 25 cities identified to potentially become a hub for the IT-BPM industry, https://www.ibpap.org/digital-cities-2025.

[50] Maritime Development Plan 2018 by the Maritime Industry Authority.

IT-Business Process Management

- Customer service systems: customer service management, interactive voice response (IVR), customer relationship management (CRM) integration, call routing, service processes, queue management, service automation, call flow design, customer portal
- Online marketing: e-commerce, search engine optimization (SEO), email marketing, social media marketing, Google Analytics
- Data science: data analysis, forecasting, statistics, analytics, SPSS, R, trend analysis, data mining, SAS, modeling
- Game development: computer programming
- Web development: HyperText Markup Language (HTML), JavaScript, cascading style sheets (CSS), Hypertext Preprocessor (PHP), web development, Extensible Markup Language (XML), jQuery, HTML5, WordPress, web services

Agriculture, Fishing and Forestry

- AI-enabled and advanced technologies used in agricultural production: farms, sustainable agriculture, animal husbandry, animal nutrition, irrigation, crop protection, organic farming
- Precision agriculture
- Urban agriculture
- Controlled environment farming: soilless agriculture, vertical farming using aeroponics, hydroponics, or aquaponics
- Drone technology: use of unmanned aerial vehicle (UAV), drone data collection and analysis
- Nanotechnology: nano-sensors for quality control, biosecurity, and general security

Agribusiness

- Food manufacturing: food safety, hazard analysis and critical control points (HACCP), food science, food technology, food microbiology, food packaging, food chemistry
- Food robotics
- 3D food printing
- Nanotechnology applications: smart packaging, nanofiltration for food processing, nano sensors for food analysis and quality control
- Online marketing of agricultural products, e-commerce
- IoT, smart kitchen, built-in sensors

Construction

- Digital design, materials management, quality control
- Architectural design applications: AutoCAD, computer-aided design (CAD), SketchUp, enterprise architecture, Revit, sustainable design, design research, architecture, green building
- VR and AR technologies for safety training, detect errors in real-time

Transport and Logistics, including Maritime

- Transportation and storage: package/freight delivery, transportation/trucking/railroad,; warehousing, airlines/aviation, maritime, logistics and supply chain, import and export
- End-to-end supply chain planning, modeling, simulation.
- Automotive and transport: product lifecycle management (PLM), electronic design automation (EDA), application lifecycle management (ALM), manufacturing operations management (MOM).
- Marine-specific
- IoT and sensors for cargo tracking, cargo condition monitoring, smart port operations
- Simulators, AR/VR, and IoT to train high-risk operations teams, both ashore and at sea through e-learning platform

Manufacturing

- Industrial and consumer electronics
- IoT devices: factory automation, industrial condition monitoring
- Mechatronics: autonomous robots, engineering CAD and drafting, mechatronics design process, microcontrollers, embedded systems programming, actuator control, sensor interfacing, programming in C, MATLAB, or Python
- Robotics: automation, robotics, control theory, process automation, machine design
- Biotechnology: wearable devices and sensors, assistive and supportive devices

Banking and Finance
- Intelligent service robots and chat interfaces, automated transactions
- Facial recognition authentication, natural language processing for fraud detection
- Cloud computing technologies, blockchain applications for real-time transactions, authentication systems
- Blockchain technology applications, embedded security and controls-development, security and operations (DevSecOps) practices

Hotel, Restaurant and Tourism
- AR/VR design and development: AR/VR systems, advanced computer vision skills, 3D modelling and desktop, web or mobile programming, CAD (computer-aided design), VR operation tools, operating wearables such as Oculus and HoloLens
- Robotics and speech recognition technology
- Blockchain applications for secure payments, ID verification and security, digital tokens for loyalty rewards programs, baggage tracking
- Big data analytics for strategic marketing and market research

Healthcare and Wellness
- AI and machine learning solutions for remote patient health monitoring
- Telemedicine, virtual exam, and consultations
- Health Information technology: IT systems, database architecture, electronic medical records data analytics, digital applications for remote health care and management

Education
- Digital teaching and learning technologies: blockchain, badging and micro-credentials
- AI-enabled teaching and learning tools, AR/VR, robots for training, digital tutors, virtual assistants
- Personalized learning, online assessments

Source: Board of Investments, Philippines Strategic Investment Priority Plan (2022), World Bank Group & LinkedIn (2018)
Note: For a detailed analysis of these skills, including the current and projected growth of these sectors and its impact on employment, see Garcia and Imaizumi (2022).

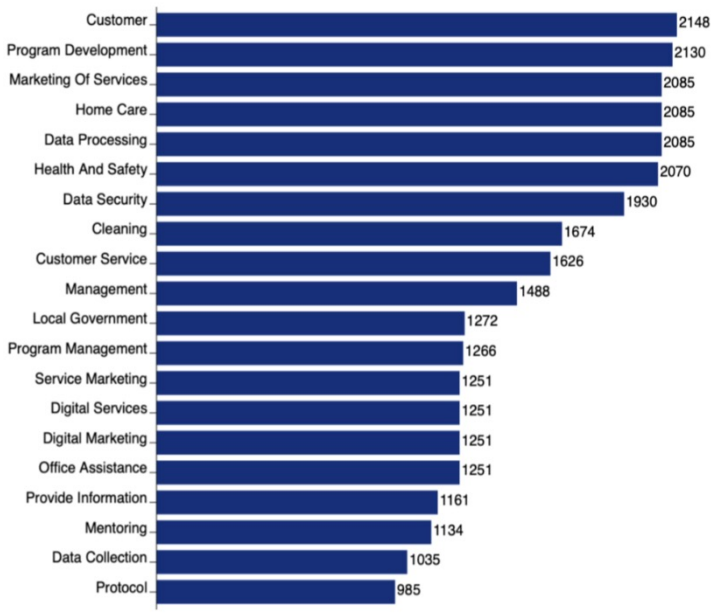
Annex 3: Top 10 Emerging Professions with High Digital Skills Content

PROFESSIONS	TECHNOLOGY AND DIGITAL SKILLS REQUIRED	INDUSTRIES THAT REQUIRE THE SKILLS
Robotics engineer	Robotic process automation (RPA), Blue Prism, UiPath, Automation Anywhere, Visual Basic for Applications (VBA)	Information technology & services (IT&S), outsourcing/offshoring, financial services, accounting, computer software
Cybersecurity specialist	Security information and event management (SIEM), information security, vulnerability assessment, network security, penetration testing	IT&S, accounting, computer & network security, computer software, banking
Customer success specialist	Customer relationship management (CRM) applications, e.g., Salesforce, Customer Retention, Customer Experience, Account Management	Information technology and services (IT&S), computer software, internet marketing & advertising, outsourcing/offshoring
Data scientists	Machine learning, data analysis, Python (programming language), R, data visualization	IT&S, financial services, telecommunications, research, outsourcing/offshoring
Sales development representatives	Lead generation, sales, sales management, CRM, setting appointments	Marketing & advertising, computer software, IT&S, outsourcing/offshoring
Full stack engineer	React.js, jQuery, Laravel, JavaScript, AngularJS Top	IT&S, computer software, internet, financial services, outsourcing/offshoring
DevOps engineers	Ansible, Amazon Web Services (AWS), Jenkins, Docker Products, Kubernetes	it&s, financial services, telecommunications, computer software, internet
Data engineers	Extract, Transform, Load (ETL), SQL, Data Modeling, Data Warehousing, Hadoop	IT&S, oil & energy, outsourcing/offshoring, financial services, computer software
JavaScript developer	React Native, React.js, Node.js, AngularJS, MongoDB	IT&S, internet, computer software, financial services, outsourcing
Cloud engineer	AWS, cloud computing, virtualization, Linux system administration	IT&S, computer software, oil & energy outsourcing, financial services

Source: LinkedIn 2020, Emerging Jobs Report, Philippines.

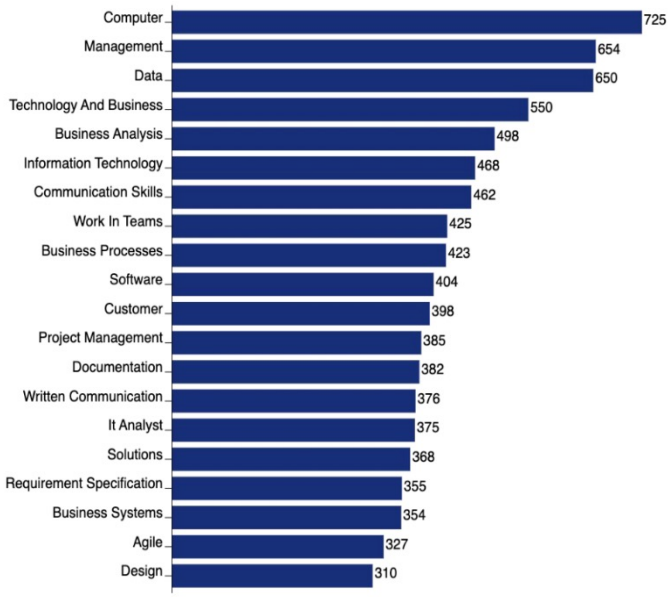
Annex 4: Top Skills Required For Select Jobs

Top Skills for a Call center Agent



Source: HeadAI 2022.

Top Skills for a Business Analyst Job



Source: HeadAI 2022.

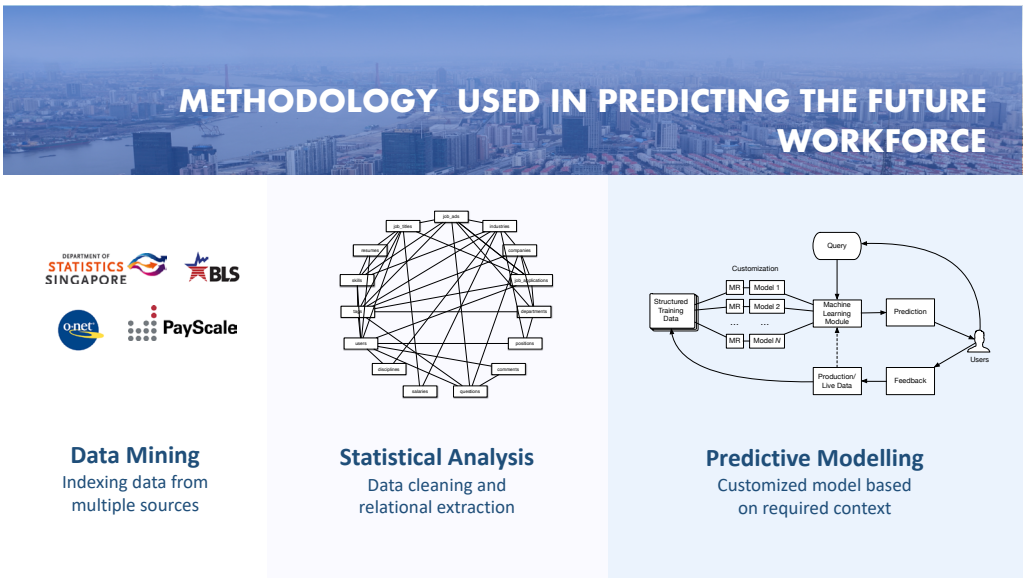
Annex 5: Methodology Used in Skills Demand and Supply in the Philippines Study: Use of Predictive Analytics

Overview

In order to develop a strategy to help colleges and universities in offering courses and curriculum which are up to date with the demands of the job market, the methodology in this report examined employment and skills development in the country. This annex briefly describes the methods, which use predictive analytics (big data analytics, artificial intelligence, and predictive modelling) to assess employment, as well as key jobs and skills required by the economy.

The projections are key information that can help students with planning for their careers and addressing their job aspirations. And, for universities/colleges to align their curriculum and syllabus to the real-time demand for jobs and skills.

To outline the employment situation in the Philippines, the study assessed the key employment generators, alongside the skills—digital skills, hard and technical skills, as well as soft skills—that are in high demand in various sectors of the economy. A methodology is used to determine how careers of students can be guided through new tools of career navigation empowered by digital transformation. Illustrations of how curriculum in universities and colleges can be adjusted and aligned to meet the demands of the job market are presented in the background paper for this report (Garcia & Imaizumi 2022).



New Analytics Applied in the Philippines Study

Big Data Analytics to decode **employer demand** and predict **future skill requirements**

Intelligent skill-gap analysis and **personalised** digital career guidance

Automatic mapping of curriculum to **granular skills** and **modular education** for youth and adults

Granular job demand information and analysis versus traditional analysis

Using predictive modelling, the top job title required in the jobsites in the country allows for reporting of demand for up to 100 to 200 top jobs by geographical area. For example, the top job titles from the PhilJob website include call center agent as no. 1, followed by production machine operator, staff nurse, and service crew. The list goes on to production controller in no. 10, sales executive in no. 15, property consultant as 47th, marketing staff as 55th, technical and commercial sales representatives as 64th. This list can go on and be reported to as granular job titles of up to 200 and beyond. This method allows workers to plan and project their skills training to be more focused and guided by data as opposed to guesswork.

Jobs demand analysis and reporting can also be aggregated into the main industries and sectors for purposes of national and regional planning. Consequently, the top 10 sectors and industries with the highest demand in the JobStreet site are: call center/IT-business processes as no. 1, followed by retail merchandising, manufacturing and production, property and real estate as 4th, construction building and engineering as 7th, computer IT software as 8th and general wholesale as 10th. From the LinkedIn jobsite, the top job groups are information technology in no. 1, outsourcing in no. 2, healthcare in no. 7, and manufacturing in no. 10.

Different jobsites attract different types of users. LinkedIn, for instance, tends to attract professionals while PhilJobNet attracts more general groups such as call center agents, customer service assistants, production and factory workers. Reporting these job demand titles across the various types of jobsites can provide a more comprehensive reporting of the kinds of jobs and skills required and enable education and training systems to respond to changing markets.

Assessing skills demand within job titles: Employing new guidance methods to improve job and career navigation

Using big data science and artificial intelligence, it is possible to detect the specific skills within the job titles. This report commissioned HeadAI from Finland, a data science and analytics group, to analyze jobsites and examine the top skills within the job titles that are in high demand in the market. By explicitly reporting the skills required for each job title, school systems are provided with the information needed for developing the curriculum, syllabus and course offerings in order to meet the demand. This contrasts with other systems that rely on unstructured understanding of market demand.

New methods of career guidance in colleges and universities: How digital transformation will help students and higher education institutions

To understand the current state of career guidance counseling for students in Philippine HEIs, two online surveys were carried out: one survey for HEI administrators and another for students, for a period of four weeks in February-March 2022. These online surveys covered a sample of 3,381 students and 126 university/college administrators from five types of higher education institutions: public state colleges/universities, public local colleges/universities, private autonomous, private regulated, and private unregulated.

Personalized career guidance for students: Using digital tools to navigate careers

The study pilot-tested a personalized skills assessment that is matched with the demand forecast for those skills. The method is called SPRI (Skills Profiling Report for Individuals) developed by JobKred (Singapore). It has been applied in Singapore, and also in other countries including Indonesia, Myanmar, and in seven countries in Africa.

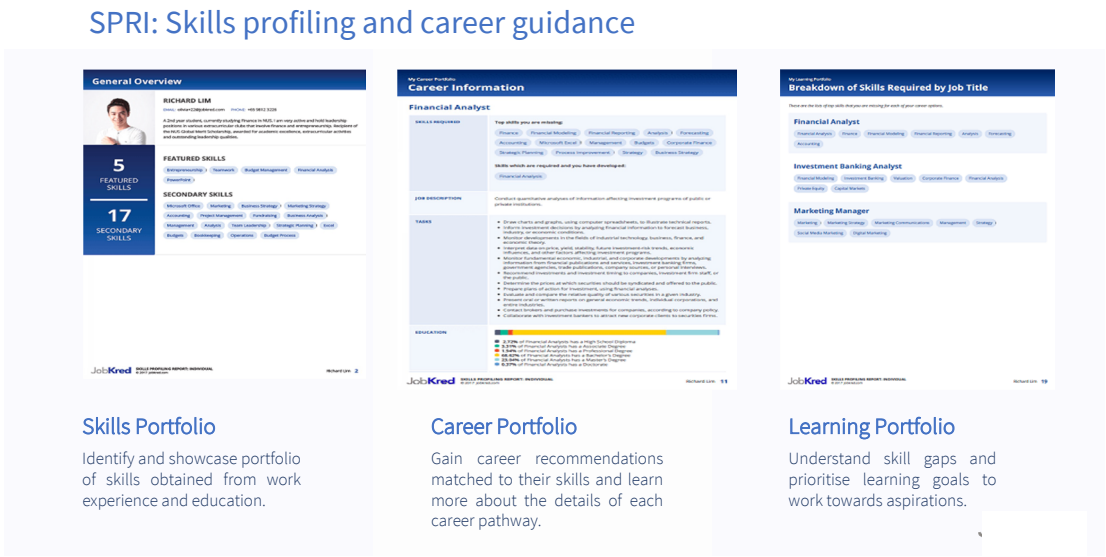
Through the digital SPRI method, students are able to: (i) identify skills matched to current jobs in demand; (ii) know their actual individual qualifications and skills; (iii) identify their chosen or favored career path;

and (iv) know the skills that are required to address the chosen or favored career path. Furthermore, the method allows users (students) to benchmark against similar profiles and career pathways. Thus, a student can navigate towards alternative career pathways and know the skills that would be needed—in granular detail. The method was pilot tested in 19 universities in the Philippines in February-March 2022, and results are described in the background paper for this study.

Methods of skills profiling and personalized career navigation: Guidance from the pilot-tests

Upon completion of the skills assessment, each student who participated and completed the skills assessment was provided with a 25-page detailed report, which includes complete details of the student's skills portfolio of work skills, experience, and education. The second part of this detailed SPRI report includes the career portfolio, which describes career recommendations that match the student's skills and thus, present their career pathways.

Through the SPRI, students can, on their own, navigate and choose the career pathways that they aspire. Most importantly, the tool would enable students to find the top jobs that are in high demand in the market and the skills for those jobs, as well as identify the learning portfolio that will fill their skills gaps towards career aspirations. The importance of these information for student career guidance cannot be overemphasized. To guide careers, students and workers need detailed information about the jobs in high demand and most importantly, the skills that employers want for these jobs. Most if not all students are coming to the job market with so much missing information on what the opportunities are as well as what they need to do to tap into those opportunities.



Some results: The navigation tool for personalized career guidance

Results for the students who participated in using the navigation tool from the 19 colleges/universities showed that 1,120 different types of careers were identified by the students who participated in the pilot, out of which the top 50 were identified. Since a large percentage of the sample of participating students came from the health care sector, a good number of the top careers chosen included medical officer, physician, nurse, epidemiologist, and lab assistant. Given that the sample also included a large percentage of students in IT and computer science, the top career aspirations included software engineer, programmer, game programmer, web developer, Python developer, data analyst, UI developer and UI designer, web software developer, and security engineer. Furthermore, in the big group from the business administration specialization, the top careers chosen included business analyst, project manager, and consultant.

Within the career paths that the participants favored, the methodology was able to identify roughly 10,000 missing skills in careers that students favored or have chosen as their career path. The skills missing include technical skills, digital skills, hard skills, and soft skills. The top skills missing include a considerable number of soft skills such as team leadership, problem solving, coaching, and public speaking. These are in addition to the hard skills and technical skills that are missing, such as data analysis, strategic planning, and business strategy. Digital skills described as missing from those students who participated in the pilot include knowledge of Windows, search engine optimization, social media marketing, blogging, and data analysis.

The digital tool for career guidance enhances the students' chances to be ready for transitioning to work, prepare themselves for the jobs, and compete for those jobs. In some instances, the skills required by the job market are not taught or are not experienced by students. The digital career guidance tool provides a path for students to identify their skills gaps and prepare themselves to acquire those skills while in school, such as by taking supplementary learning through MOOCs and other online courses. These courses are available on the internet, many of which are free, with some courses offered for a minimal cost.

Curriculum alignment: Using data science and artificial intelligence tools to align the university/college curriculum with real-time job and skills demand

To address the challenge for colleges and universities to keep the curriculum up to date with the demands of the job market, the World Bank study implemented a pilot testing of a methodology of a new curriculum navigation tool developed by HeadAi of Finland (www.Headai.com) that uses cognitive artificial intelligence and predictive analytics. This tool is used in universities in Finland and applied elsewhere in the world including Kenya and other countries.

The study piloted the tool in 19 colleges and universities in the Philippines, namely: Batangas State University - The National Engineering University, Bukidnon State University, University of the Philippines System (comprised of UP Diliman, UP Los Banos, UP Manila, UP Visayas, UP Open University, Up Mindanao, UP Baguio and UP Cebu), Mapúa University and its subsidiaries Malayan Colleges Laguna and Malayan Colleges Mindanao), Iligan Medical Center College, University of the East/Manila, Samar State University, Mariano Marcos University, Tanauan City College, and Jose Rizal University.

Curriculum alignment navigation map

The tool developed by HeadAi enables spotting of trends automatically through machine learning, such as the changes in demand and supply of skills in the regional market and even in the international market. Using the granular job and skills data from jobsites, the jobs and skills in high demand are defined. The skills supply expressed in terms of the curriculum and syllabus was provided by the colleges and universities chosen for the pilot. For purposes of the pilot, courses in health sciences, IT and computer science, and business administration were chosen.

Simulations in trends in skills demand and skills supply are visualized as a two-dimensional skills map, in which the similarities (thus, matching) between demand and supply appear in different colors, such as blue for a full-match between demand and supply, shades of dark to light green as levels of match, and pink as no match between skills demand and skills supply. Through this cognitive AI, the process of matching automates the identification of demand and supply and facilitates in examining the connections and relations between the two.

Curriculum alignment in Business: The case of the Bukidnon State University

To illustrate the process of aligning the curriculum to address the opportunities in job and skills demand, the methodology by HeadAi translates the analysis of the gaps into a curriculum alignment map, as shown in the figure in this annex. The curriculum alignment map is read like correlation matrices in statistics but presented

graphically. The goal is to look for strong correlations between demand and supply of skills. The alignment map would help the university/college to (i) understand what skills are in demand now and in the near future and predict the changes in demand, (ii) guide curriculum development and updating, and (iii) understand how to develop a more competitive course offering to meet market needs.

The university departments will be able to discern from these maps the parts of the curriculum that would need to be examined for their alignment to the needs of the market. In other words, these provide the map to help navigate specific opportunities for the curriculum updating process, so that they align with the needs of the market. The example provided here is for the Business Department of the Bukidnon State University.

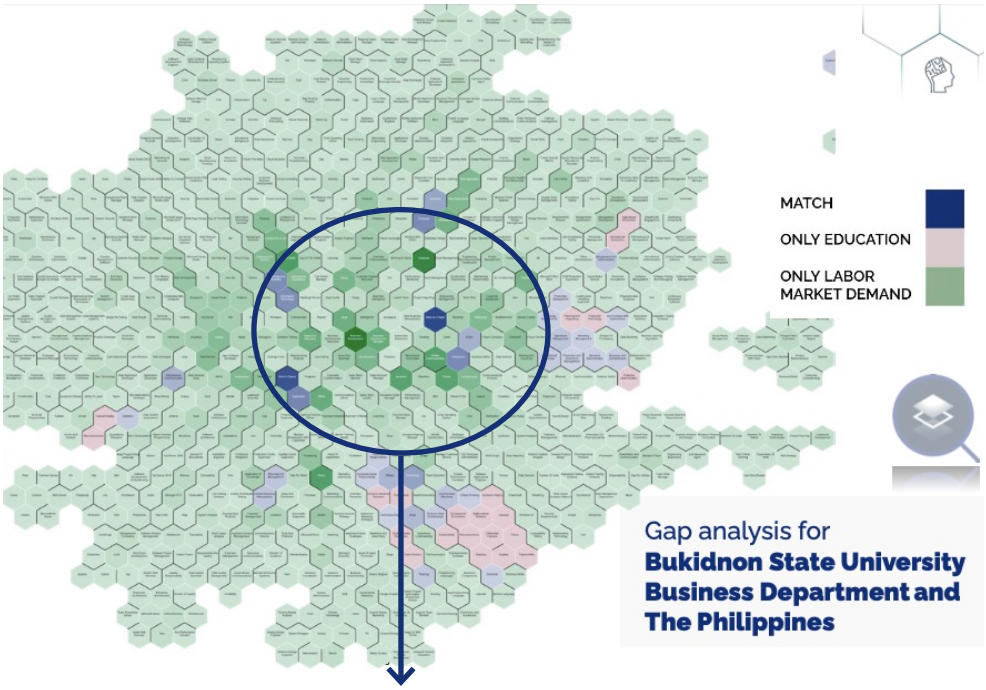
Figure 13 describes the results from the simulations for skills in the curriculum (supply) and all the skills needed by the market (demand). The various shades of blue (dark to light), green (dark to light), and pink represent strength of match between demand and supply. In the map, the blue cells represent matching supply and demand, green shows there is demand but the curriculum is not supplying it, while pink shows the curriculum supplying but no demand in the market. A darker shade of blue means there is a greater number of curriculum offerings that supply the skills relevant to demand.

Bukidnon State University curriculum data suggests emphasis on economics, ethical practice, research, and leadership. A match in course offerings and labor market demand is strong for soft skills linked to business such as the ability to work in teams, working as a team, and interpersonal communication, and for role-specific skills such as production management, operations management, marketing management, and technology management.

On the other hand, the market requires skills that are not adequately covered by the curriculum. These include IT skills linked to business such as database knowledge, application development, and software as a service. Other industry-specific skills also need to be addressed such as business development, sales and marketing, and knowledge in policy. Furthermore, there continues to be a gap in soft skills such as customer satisfaction and written communication, and in digital skills such as the use of software like Microsoft Excel, Microsoft Office Word, and Oracle PL/SQL. It is also instructive to see those marked in pink (as offerings with no market demand) such as international economics, planning and organizing, and financial administration. However, these are still relevant as they are foundational skills for the other skills.

In this curriculum alignment map, there is also strong demand in the market for the ability to work in shifts and in leadership skills such as coaching. The final decision on what aspects of the curriculum to modify or adapt to respond to this demand is left to professors and deans in academic departments who are in charge of the curriculum and syllabus for particular course offerings in the college/university. By automating the routine tasks of matching demand and supply of specific skills, the process saves time and improves the development work of keeping the curriculum up to date with job market demand. The process also provides a more dynamic tool that can help in the timely alignment of the curriculum offerings with market demand because the forecast of demand for skills can be obtained from the analysis of the current trends in the jobs postings from jobsites, and from the relevant forecast from the JobsFit labor market information reports of the Philippines' Department of Labor and Employment.

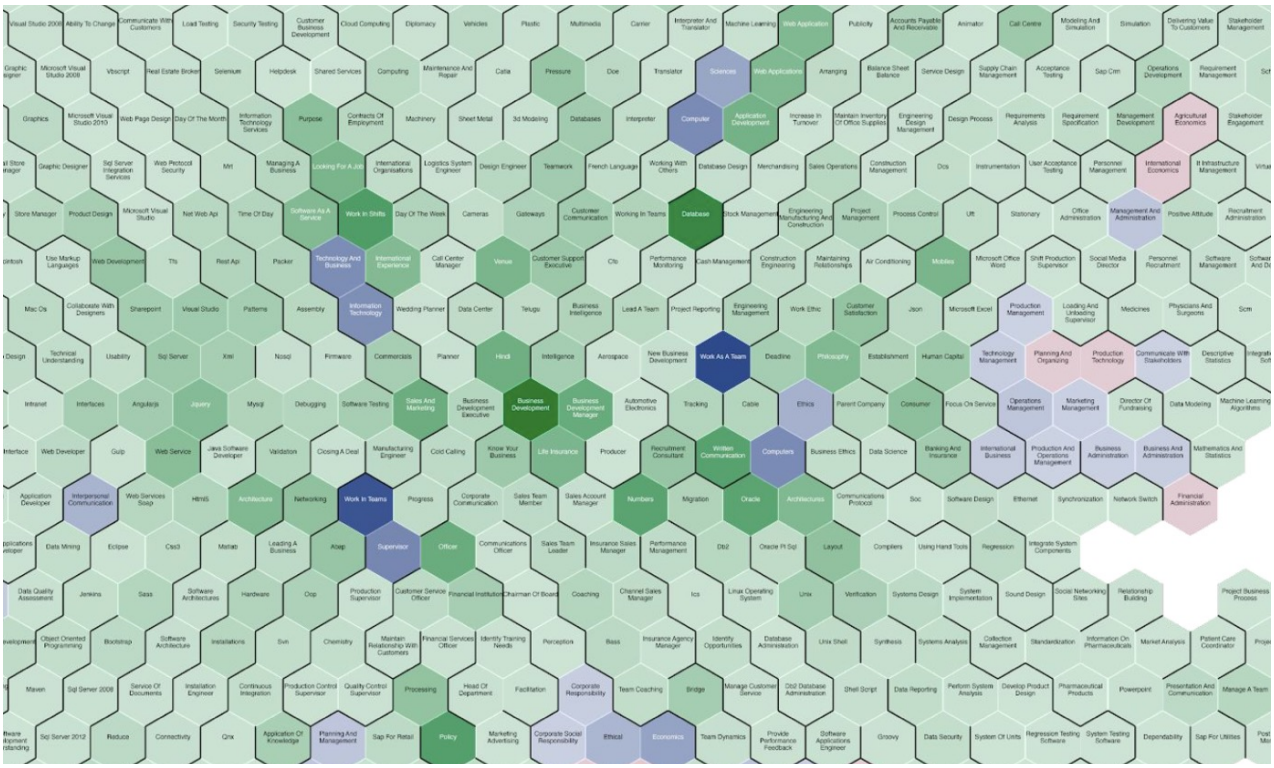
Figure 13. Curriculum Alignment Map: Towards Skills Required in the Job Market



Blue cells: *Supply of skills (curriculum) that match skills demanded by the job market*

Green cells: *Demand for skills not offered in curriculum*

Pink cells: *Supply of skills (curriculum) not in high demand from the market*



Source: HeadAI 2022.

Annex 6: In-Demand and Hard To Fill Occupations, 2013-2020

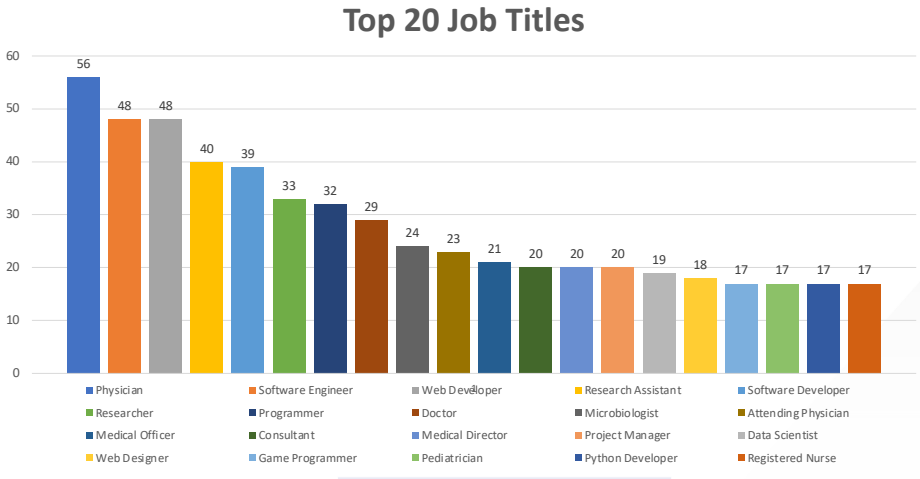
OCCUPATION	SECTORS
Accountant	Agribusiness, banking and finance, education, IT-BPM, manufacturing, restaurant and tourism, ownership, dwellings, real estate, wholesale and retail trade hotel
Accounting Staff	Agribusiness, banking and finance, ownership, dwellings, and real estate, wholesale and retail trade
Agriculturist	Agribusiness
Air-conditioning technician	Power and utilities, transport and logistics
Animator	IT-BPM
Civil engineer	Agribusiness, construction, mining, ownership, dwellings, and real estate
Chemical engineer	Manufacturing, power and utilities, renewable energy
Computer programmer	IT-BPM, wholesale and retail trade
Draftsman	Health and wellness, manufacturing
Electrical engineer	Agribusiness, manufacturing, mining, ownership, dwellings, and real estate, renewable energy, wholesale and retail trade
Electrical technician	Manufacturing, power and utilities
Food technologist	Hotel, restaurant and tourism, manufacturing, wholesale and retail trade
Geodetic engineer	Mining, Ownership, Dwellings, and Real Estate
Heavy Equipment Operator	Construction, manufacturing, mining, power and utilities
Human resource manager	Education, wholesale and retail trade
IT specialist	IT-BPM, manufacturing, wholesale and retail trade
Industrial engineer	Agribusiness, manufacturing
instrumentation technician	Agribusiness, manufacturing, power and utilities
Landscape artist	Hotel, restaurant and tourism
Legal transcriptionist	IT-BPM
Machinist	Construction, manufacturing
Materials engineer	Mining
Mechanical engineer	Construction, hotel, restaurant and tourism, manufacturing, power and utilities, ownership, dwellings, and real estate, renewable energy, wholesale and retail trade
Medical technologist	Health and wellness, manufacturing
Metallurgist	Mining, power and utilities
Nutritionist	Health and wellness
Pharmacist	Health and wellness, manufacturing
Physician	Health and wellness
Sanitary engineer	Construction, power and utilities
Software developer	IT-BPM
Systems analyst	Manufacturing, power and utilities
Veterinarian	Agribusiness
Web designer	IT-BPM

Source: Department of Labor and Employment 2021.

Annex 7: Job Titles Favored By Students versus Missing Skills

Figure 14. Top 20 Job Titles/Careers Favored by Students

Close to 1120 unique careers were favored/chosen by students who participated in the pilot



Total Job Titles Favourited: 3268

Total Unique Job Titles Favourited: 1120

10

Source: Garcia & Imaizumi 2022.

Figure 15. Top 21st to 50th Job Titles/Careers Favored by Students

Top 21st to 50th careers favored/chosen by students who participated in the pilot

No.	Career	No. of respondents
21	Family Physician	16
22	Resident	16
23	Manager	15
24	Nurse	15
25	Quality Assurance	15
26	Resident Physician	15
27	Data Analyst	14
28	Developer	14
29	Front-End Developer	14
30	Game Developer	14
31	Research Associate	14
32	Research Scientist	14
33	Scientist	14
34	Staff Nurse	14
35	Business Analyst	13

No.	Career	No. of respondents
36	Epidemiologist	13
37	Graphic Designer	13
38	Surgeon	13
39	UI Designer	13
40	UI Developer	13
41	Web Software Developer	13
42	Analyst	12
43	Physical Therapist	12
44	Research Technician	12
45	Teaching Assistant	12
46	Graduate Research Assistant	11
47	Lab Assistant	11
48	Nurse Practitioner	11
49	Professor	11
50	Security Engineer	11

11

Source: Garcia & Imaizumi 2022.

Figure 16. Top 20 Skills Missing (Skills Gap) from Favored Careers of Students

Source: Garcia & Imaizumi 2022

Figure 17. Top Missing Skills (Skills Gap) in Favored Careers/Jobs of Students

Top 21st to 50th missing skills identified in the favored careers/jobs of students who participated in the pilot

No.	Missing Skill Name	No. of Respondents
21	Fundraising	410
22	Project Management	410
23	Business Development	409
24	Data Analysis	409
25	Management Consulting	409
26	Negotiation	409
27	Budgets	408
28	Consulting	408
29	Entrepreneurship	408
30	Strategic Planning	408
31	Higher Education	407
32	Mentoring	407
33	Social Media	407
34	Integration	406
35	Nonprofits	406

No.	Missing Skill Name	No. of Respondents
36	Process Improvement	406
37	Training	406
38	Troubleshooting	406
39	Blogging	405
40	Strategy	405
41	Customer Service	404
42	SEO	404
43	Social Media Marketing	404
44	Writing	404
45	Leadership Development	403
46	Security	403
47	Online Marketing	402
48	Windows	402
49	Business Strategy	401
50	CRM	401

- *Soft Skills*
- *Business related skills*

13

Source: Garcia & Imaizumi 2022

Annex 8: Governance of Digital Transformation

CHED aims to address the organizational challenges that the Philippine higher education sector has faced by promoting digital transformation built on clear foundations and well-defined pillars. Whereas CHED set policies, institutions' administrators managed campuses, faculty members taught students, and information technology departments provided maintenance and technical support. While this allowed the growth and expansion of educational programs in universities, it also created silos that prevented the accelerated adoption of technology across organizational units. In some cases, IT departments focused on the acquisition of devices and improvement of network strength, and administration and faculty focused on student outcomes, with little coordination and collaboration between the two groups.

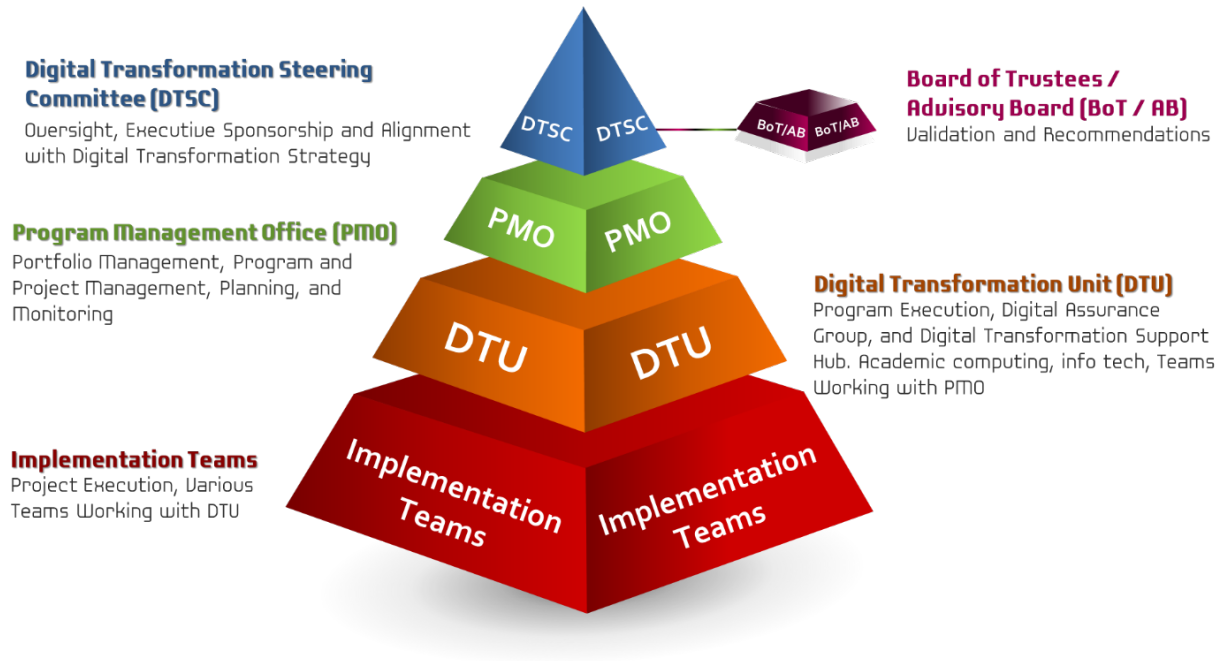
Cross-Functional Governance

With the cross-functional governance model for digital transformation, CHED aims to ensure that its sectoral strategic and institutional goals, as discussed in Chapter 1, can be achieved. The cross-functional governance model, which is based on the ISO 38500 standard, takes into consideration risk assessment and management as well as strategic alignment with the strategic goals. With the model, CHED can evaluate the needs of stakeholders, the prevailing conditions and options for addressing those needs, while (i) providing guidance to HEIs on prioritization and decision-making processes; (ii) monitoring progress and compliance with standards; and (iii) measuring performance against the strategic goals. Efficient management of human and financial resources is vital in managing costs and sustaining action plans. Monitoring performance and reporting lessons learned and achievements are important and can provide visibility to the leadership teams and other stakeholders. The governance model ensures that stakeholders are aware of their responsibilities and are accountable for them.

Digital Transformation Governance Structure

The digital transformation governance structure consists of four levels, as illustrated in Figure 18. The structure spans across the higher education sector and institutions, where the top is managed by the most senior official at the system level, i.e., the Office of the Chairperson and Commissioners and the Office of the Executive Director of CHED, while the actual implementation is done at institution level. Table 8 gives an overview of the structure and composition of each of the teams, units, and committees within the governance structure and their respective roles and responsibilities.

Figure 18. Governance Structure



Roles and Responsibilities of Governance Bodies

The roles and responsibilities within the governance structure are performed by governance bodies, thus providing the foundation for a high-performing organization, preserving and strengthening stakeholder confidence, and ensuring that the organization is well placed to respond to a changing external environment. The following table identifies the necessary processes and assigns them according to the governance structure.

Table 8. Roles and Responsibilities of Governance Bodies

GOVERNANCE BODY	ROLES AND RESPONSIBILITIES
Digital Transformation Steering Committee (DTSC)	The DTSC oversees all programs and projects in the digital transformation (DX) portfolio to ensure their alignment with CHED Strategic Plan 2022-2028 and CHED's digital transformation strategy. The DTSC's responsibilities are as follows: • Define, develop, and update the strategy and action plans and approve subsequent revisions. • Obtain validation and recommendations on the strategy and action plans from the CHED Board of Trustees and Advisory Board (BoT/AB). • Provide political and high-level leadership for the strategic goals and actions at the system level. • Provide high-level guidance and strategic decision making on the implementation of the strategy and action plans. • Support and provide oversight on the overall strategy and action plans, including (i) portfolio of programs and projects, (ii) priorities, (iii) budget, (iv) timeframe, (v) resources, and (vi) key performance indicators (KPI). • Conduct periodic reviews of the overall status of the DX portfolio, programs and projects delivered by the project management office (PMO) and monitor their progress and alignment with the strategy. • Approve the project governance structure.

GOVERNANCE BODY	ROLES AND RESPONSIBILITIES
	• Ensure that adequate funding is allocated for the various programs in the DX portfolio. • Identify risks, issues, and dependencies, and find solutions to achieve overall objectives and keep the programs on track. • Provide executive support in change management for all DX programs to increase the chances of success and encourage support and involvement of HEIs. • Manage potential and complex issues with external stakeholders. • Resolve escalated and complex issues, as necessary, including the issues escalated by the PMO. • Coordinate with the PMO to ensure that appropriate support and standards are implemented across all portfolios of programs and projects. • Conduct bi-monthly meetings with the PMO to review project plans and statuses and discuss issue escalations requiring DTSC intervention. • Instruct the audit unit to conduct ad hoc or periodic audit functions. The DTSC is headed by a high-level national official, e.g., Chairperson of CHED, Department Secretary, or a representative. It consists of senior officials of HEIs, including the following: • For senior leadership: presidents of chancellor advisory boards • For administration: director generals, vice chancellors, chief operating officers, chief financial officers, vice presidents for administration and human resources • For academic affairs: provosts, vice chancellors for academic affairs • For technology: chief information officers, chief technology officers, chief data officers • For research and innovation: vice chancellors, vice provosts for research
Board of Trustees and Advisory Board (BoT/AB)	The members of the BoT/AB are composed of advisors from the education sector, including representatives from HEI boards of trustees; student governments; organizations, associations, or unions of faculty members, employees, and alumni; and subject matter experts from various fields. • The BoT/AB has the following functions: • Support the DTSC in an advisory capacity. • Advise the PMO and digital transformation unit (DTU) on the strategy's action plans. • Provide input and feedback on programmatic issues. • Share relevant information and materials. • Support critical stakeholder engagement and public relations functions. This group brings specific knowledge and skills that complement those of the DTSC. The BoT/AB validates and makes recommendations on the strategy, portfolio, programs, projects, procedures, and processes to attain the strategic goals. Its role is recommendatory, and it has no formal authority to govern.
Program Management Office (PMO)	The PMO plans, manages, and monitors the DX portfolio of programs and projects to ensure the achievement of intended goals and outcomes. The PMO's responsibilities are as follows: • Manage the entire portfolio of DX programs and projects. • Survey the HEIs and collect their requirements for digital transformation projects. • Conduct project feasibility assessments. • Review proposed projects and endorse them for the approval of the DTSC. • Ensure that all programs across HEIs are coordinated, aligned with the strategy, and support the achievement of strategic objectives. • Monitor the portfolio of programs and projects and measure its impact. • Support and provide program planning and prioritization of projects and activities. • Provide oversight of program implementation to help the programs achieve their intended goals and outcomes. • Provide support in change management, procedure simplification, and process re-engineering. • Produce guidance on standards and best practices that can help digital transformation units (DTUs) with their action plans. • Provide standard project management tools to the DTUs. • Support cross-functional teams on the use of the project management tools.

GOVERNANCE BODY	ROLES AND RESPONSIBILITIES
	• Conduct post-mortems and capture, communicate and incorporate lessons learned. • Provide training, mentoring, and coaching on project management. • Tap local and international experts who can provide support for DX projects. • Support the development of appropriate digital skills and help build a culture that advances digital transformation of higher education services. • Support, develop and share KPIs that are aligned with strategic objectives. • On the request of the DTSC and on a regular basis, conduct the following audits of programs and projects: • Project Audit: timeline, deliverables, resources, risks, and issues • Financial Audit: projects and their budgets • Legal Audit: compliance with national, sectoral, and institutional rules and regulations • Report to the DTSC.
Digital Transformation Unit (DTU)	The DTU serves as a digital transformation support hub. The DTU coordinates the various initiatives in HEIs to accomplish the following: (i) avoid duplication of initiatives, (ii) improve the architecture and interoperability of digital services, and (iii) apply digital principles and models on the initiatives to promote effectiveness, such as the use of the digital course design model and AI modeling in predicting student behavior. The DTU focuses on re-engineering processes, simplifying procedures, and unifying digital design models. DTU members are composed of specialists from HEI digital transformation groups. Each HEI will have a focal person who will coordinate with the DTU. The DTU's responsibilities are as follows: • Lead the technical implementation of the digital transformation strategy for Philippine higher education. • With the help of the PMO, ensure the standardization of shared digital-by-design e-services and common platforms to achieve economies of scale and expedite the delivery of services. • Coordinate and follow through on the progress of DX projects established in various HEIs. • Provide technical oversight over the implementation teams and their DX tasks and activities. • Provide digital quality assurance service through the digital assurance group (DAG). • DAG will be independent of government and the higher education sector itself. • DAG must have sufficient resources—financial, human, and intellectual—to be able to perform its responsibilities. • DAG will have carefully developed procedures for engaging with the broader society that higher education systems have a responsibility to serve. • The quality requirements must closely reflect those of non-digital learning but include specific focus on details such as mode of delivery, method of assessment and ensured accessibility. • Escalate any significant issues or risks to the PMO.
Implementation Teams	Composed of various functional groups, the implementation teams are responsible for project execution within their respective HEIs. These groups are made up of multiple teams working in parallel on different projects. • **Legal and organizational group** - coordinates all legal and organizational aspects of digital transformation. Responsible for the following tasks: – Participate in drafting the necessary legal instruments and adjustment of existing ones. – Provide operational instructions. – Provide organizational change management. • **Technical group** - consists of project managers and similar functions that implement projects. Responsible for the following tasks: – Implement projects in their HEIs. – Coordinate all activities related to project implementation, including synchronizing interrelated tasks. – Facilitate communication with external stakeholders and institutions when needed. – Coordinate the development of training programs and training of employees involved or affected by DX initiatives. – Report to the DTU regularly. – Escalate critical issues or risks to the DTU. – Facilitate the approval and endorsement of key deliverables.

Source: Authors

Annex 9: Pillars of Digital Transformation

Digital transformation requires significant cultural and process changes that may be challenging to implement. Behavioral change occurs at various levels—among staff, students, and administrators. The forced adoption of new technologies is often met with active and passive opposition. With such resistance, institutions will certainly struggle to keep the lines of communication open between stakeholders, administrators, and departments within the organization. To facilitate the transition to a new process and culture, HEIs should establish clear objectives and carefully plan the timing of the transition. Open communication and engagement with stakeholders can be combined with agile and efficient management approaches.

There are four pillars upon which a solid digital transformation strategy is built: (i) Culture, (ii) Human Capital, (iii) Processes, and (iv) Innovation. These pillars will uphold and support the vision and objectives of the strategy.

Culture

Digital transformation is "a series of deep and coordinated culture, workforce, and technology shifts that enable new educational and operating models and transform an institution's operations, strategic directions, and value proposition" (Brooks & McCormack 2020). Digital transformation is often interchanged with *digitization* (of analog information) and digitalization (of processes). However, DX is different as it is more complex and more impactful. Most fundamentally, digital transformation requires organizational and cultural shifts. Changes in organizational culture are essential to achieve a successful digital transformation. DX will stimulate a new culture and a new mindset, which will require new processes to embrace the effective use of digital tools, improve digital literacy, and foster an open culture of cross-discipline collaboration and innovation that rely on data analytics for decision making and planning. HEIs must shift their orientation from silos to institution-wide goals. They should build a culture of openness to establish new channels of communication and engagement among students and other actors within the HEIs. Without understanding the need for a cultural shift, digital transformation strategies and implementation plans become mere automation projects.

Human Capital

Digital transformation requires restructuring the workforce within institutions to ensure the deployment of adequate personnel with the right skills for the right roles. Although digitalization will render many jobs obsolete, new jobs will be created and the same work will need to be performed using new methods and equipment. Digitalization is revolutionizing how HEIs operate and provide services to students and researchers. Making digital transformation a reality requires human assets with the right skills to affect the transition. A human capital shift must occur, and this will require better teamwork, collaboration, and communication skills. This shift will help align the roles of digital technologies and data in administration, teaching, learning, and research in the HEIs.

Faculty Preparedness

Successful face-to-face teaching does not always translate to successful online education: teachers must deliver the courses and implement the teaching program effectively. Online teaching requires more effort from teachers who need to compensate for the lack of physical presence and interaction with students. They also need to possess digital competencies in addition to their content knowledge, pedagogical and communication skills. Resistance to change will impede digital transformation. For instance, faculty members may feel that online teaching results to an increased workload, especially when they are new to the concept of virtual learning. To support faculty members in the transition, HEIs must invest heavily on teacher training, establish open communication with the staff, and ensure the adoption of user-friendly tools. While significant changes in teaching approaches, assessment methods, and preparation of learning materials may result in

additional workload in the short run, the process will eventually stabilize and transform into doing things differently in the future.

Teachers may benefit from the following courses:

- Best practices for instructional design of online courses
- Principles of pedagogy in online education
- Theory and practice of adaptive learning
- Designing accessible digital learning content (for persons with disabilities)
- Establishing instructor presence in online education
- Facilitating online discussions
- Developing measurable learning objectives for online learning
- Assessing students online
- Grading and providing meaningful feedback in online education
- Using LMS features and functionalities

Institutional incentives and regulations can influence teachers' motivation to reform their teaching. Teachers' practical approaches to teaching tend to be heavily influenced by situational factors, the teaching environment, and the academic discipline or field of study. Research shows that the lack of institutional support for digital education is a main cause of concern among teachers. Few universities have developed incentive schemes that account for the unique aspects of digital education, such as the considerable workload during the design phase. An urgent step that institutions can take is to provide incentives that will compensate teachers for their work in digital education and guarantee their ownership of video lectures and other digital materials, which were created without direct institutional involvement or support. The teachers should likewise be compensated if their work is reused by the institution. Although this may be costly in the short term, increased opportunities for the reuse of digital materials may in fact be more cost efficient. To take full advantage of such opportunities, there should be educational leadership and planning across units and programs.

The intermediate digital skills of faculty and students can be improved through teaching and learning. To meet the growing demand for higher education, online learning courses can be expanded and offered beyond the campus to reach more students. Additionally, expanding the use of technology for teaching and learning in classrooms can develop student communication and collaboration skills, digital content creation skills, and problem-solving skills. This approach allows the students and faculty taking the coursework to learn those skills and apply them in their course of study. Regardless of the adopted technology framework, students require strategic and purposeful opportunities in teaching and learning settings to acquire, practice and improve their digital competencies. Offering more online courses and updating existing courses so that they leverage technology and support digital skills goals will involve multiple stakeholders in making key decisions, building the infrastructure, and implementing the appropriate policies.

Digital Skills

Generating support for digital transformation from different stakeholders is key to the effective use of digital tools. The need for technology and digital tools goes beyond the IT discipline; it extends to the curriculum, pedagogies, and administration. It is important that students, faculty members, and non-academic staff are well informed and comfortable with the use of digital tools. Tutorials on how to use the plugins or tools in an LMS, e.g., how to subscribe to groups, add task reminders, structure assignment schedules, and take online exams are useful to students. Faculty members need to be well versed and creative in using the digital tools. IT staff should likewise be well trained to be able to provide the needed support for solving IT issues and implementing IT processes.

Digital literacy as well as media and information literacy play an important role in higher education. Digital literacy is regarded as an umbrella framework of skills, knowledge, and ethics. A digitally literate person can identify, access, manage, integrate, evaluate, analyze, and synthesize digital resources. Digital competence involves *situational embedding* or the effective use of digital media in life situations. Digital usage is the application of digital competence within specific professions or context, so that it becomes *embedded and evolved* in the community. Finally, digital transformation is the application of digital usage to contribute to innovation and creativity in a profession or knowledge domain.

One effective approach to digital skills integration in the curriculum and pedagogy is scaffolding, which involves the use of active digital learning pedagogy to help students learn crucial digital skills as they work toward a course-specific goal. Digital technology should offer personalized, flexible, student-centered, collaborative, and creative learning activities. For example, students can be asked to track course-specific resources or activities through a spreadsheet program or websites that store responses to assignments. These activities can help non-science, technology, engineering, and mathematics (STEM) students experience high-tech environments so that they can develop the digital skills that are required in today's job markets. Meanwhile, more advanced courses can include basic code writing or textual analysis skills as tools for achieving course-specific goals.

Processes

Digital services must use innovative ways to improve user experience in academia, administration, and research. Inefficient processes must be streamlined, and their procedures simplified before automating them to ensure a positive outcome. Business process re-engineering should simplify and optimize processes, and thereby improve university life for students and staff. Moreover, by streamlining processes and adopting a digital-by-design approach that considers all administrative and academic processes as part of a unified digital architecture, HEIs will achieve economies of scale.

Organizational Structure

The organizational structure of a HEI needs deep and coordinated shifts to enable digital transformation. The structure should include the implementation units described in the governance structure in Figure 18. It should avoid technology function-oriented models where digital technologies are managed categories such as infrastructure or operating systems. Instead, the structure should be aligned with the institution's academic and research mission. This means that the organizational structure within an institution should reflect the functions of the committees in charge of specific domains, such as the following:

- Education
- Research, scholarships, and creativity
- Private sector partnerships
- Administration
- User experience

The committees should be composed of stakeholders outside the IT department and should include faculty and decision-makers from the institution's academic and business units. By including stakeholders outside IT during the design process, the institution can gain a broader perspective of the impact of digital transformation across the institution. This model also enables the institution to have the potential not only to transform the relationship between IT and the rest of the organization, but also help prepare the institution as a whole for the rapid changes occurring in technology and higher education. The committees can anticipate the potential impacts of digital transformation based on their experiences in their domains—be it teaching, research, or administration—and advocate for a role in helping the institution prepare for digital transformation.

Performance Management

HEIs must review their organizational structure to determine where organizational shifts are needed to drive performance and improve transparency and efficiency. Leadership teams across the sector must measure performance and use it as a basis for performance management and strategic planning. The lack of vital operational information and financial data is a major challenge, with these data often scattered, inconsistent, or inaccessible in silos. As digital transformation programs are implemented, HEIs will standardize their performance data and produce data-driven insights. They will also increase transparency and accountability, evaluate their goals, and continuously improve their performance.

Using Digital Tools

Using data analytics and digital tools in decision making is vital to successful digital transformation. In fact, the use of digital tools also applies to designing and defining business processes as part of organizational transformation. Blended learning and digital teaching in general rely on the adoption of digital tools and technologies. Therefore, the higher education sector should consider adopting a unified approach to standardizing digital tools to achieve economies of scale and faster implementation of digital programs.

Standards and Compliance

Setting standards for stakeholder-centered information, digital services, and data classification will improve the quality of digital transformation in the higher education sector. Standards enable technical interoperability, reuse of digital components, data sharing, and quality assurance across the sector. Standardization of content, systems and processes will improve quality, strengthen integration and coordination, ensure compliance with laws and regulations, and promote a consistent digital experience among users. Adopting open standards is recommended because they are more transparent, and they can help HEIs avoid unnecessary vendor lock-ins. A standards-based approach also widens the choice of suppliers or vendors that provide digital services in the sector. Other standards, guidelines, and frameworks, such as the use of personal data, cybersecurity, cloud security, digital assurance, change management, and governance will be developed collectively and adopted by all HEIs. While HEIs have no legal obligation to comply, CHED has the responsibility to set the standards and it can incentivize HEIs to adopt them.

Data standards

In consultation with data owners in the public sector, CHED will develop a standard approach for structuring information effectively across government entities and HEIs. Adopting a uniform data classification standard, which will build on an appropriate data governance structure, will help in the consistent implementation of data usage policies in the higher education sector. Data standards provide a basis for a common approach that safeguards the privacy of individuals in transactions that use personal data. This common approach also protects confidentiality in shared services that use sensitive information. Equally important, data classified as public can be systematically archived.

Data classification standards

Digital transformation initiatives must take into consideration data security and compliance while making better data-handling decisions. Data security standards are clearer and easier to understand and follow when data are appropriately classified. Typical data classification labels are as follows:

- **Unclassified:** Data that are unrelated to any entity or individual. Data are stored unencrypted.
- **Public:** Data related to any entity or individual, prepared, and approved for public consumption.

- **General:** Data related to an entity or individual that are not meant for public consumption; however, these data can be shared with employees within the HEIs and CHED.
- **Confidential:** Data that are sensitive, including strategic information, that could be harmful if shared inappropriately. Personal information is included in this category. Data owners can track and revoke content. Recipients can delegate their access rights to others.
- **Highly Confidential:** Data that are critical, highly sensitive, and high risk, including personally identifiable information and information that are regulated. Data owners can track and revoke content. Recipients cannot delegate their access rights to others.

Digital-by-design standard

Digital services in higher education should be conceptualized and planned as digital-by-design to ensure that digital and face-to-face learning modes co-exist, and students can choose the learning modality that best suits their needs. This recommended paradigm shift puts active digital learning, teaching, and assessment at the core of all future stakeholder engagements. In learning that is truly digital by design, students have an enhanced set of learning experiences and can move seamlessly between physical and virtual environments that are supportive, stimulating, engaging, challenging, and inspiring. Digital-by-design recognizes the need to move beyond generic competences in digital education to enhance pedagogical capacities of educators tasked with teaching in a digital world. It considers the needs of differentiated disciplinary contexts and responds to sectoral strategic priorities around capacity planning for digital education.

Platforms standard

Platforms provide a standard for operating the various building blocks of a digital economy. The lack of standards has been identified as a barrier to innovation. Open platforms foster communication and cooperation among developers and stakeholders, and this can help overcome the barriers to efficiency. Open platforms also reduce costs and remove redundancies, thus making the reuse and integration of previously developed components and solutions possible.

Interoperability standard

The Philippine higher education sector will work with government agencies and departments in setting up a national interoperability platform to ensure compatibility and integrity of data exchange among digital service providers in the Philippines. Defining and abiding by an interoperability standard will provide higher education stakeholders with accurate and timely data and eliminate data redundancies and silos. The interoperability standard must be preceded by a data classification standard.

Information security standard

Information security will be implemented based on the ISO 27001 standard. In addition, information security risk management plans will be implemented based on ISO 27005.

Operations continuity standard

To ensure the continuity of digital service operations in higher education and uninterrupted user access to these services, CHED will establish business continuity policies, processes, and procedures for a standardized and uniform approach. The operations continuity standard will be based on the ISO 22301 standard.

Innovation

Exploring emerging technologies while implementing a digital transformation strategy is crucial. As modern technologies emerge, some economic sectors decline while others thrive. Several emerging technologies can improve the quality of higher education as they enable more innovative and engaging teaching methods and learning experiences. Some of the most significant emerging technologies and practices in higher education are described in the following sections.

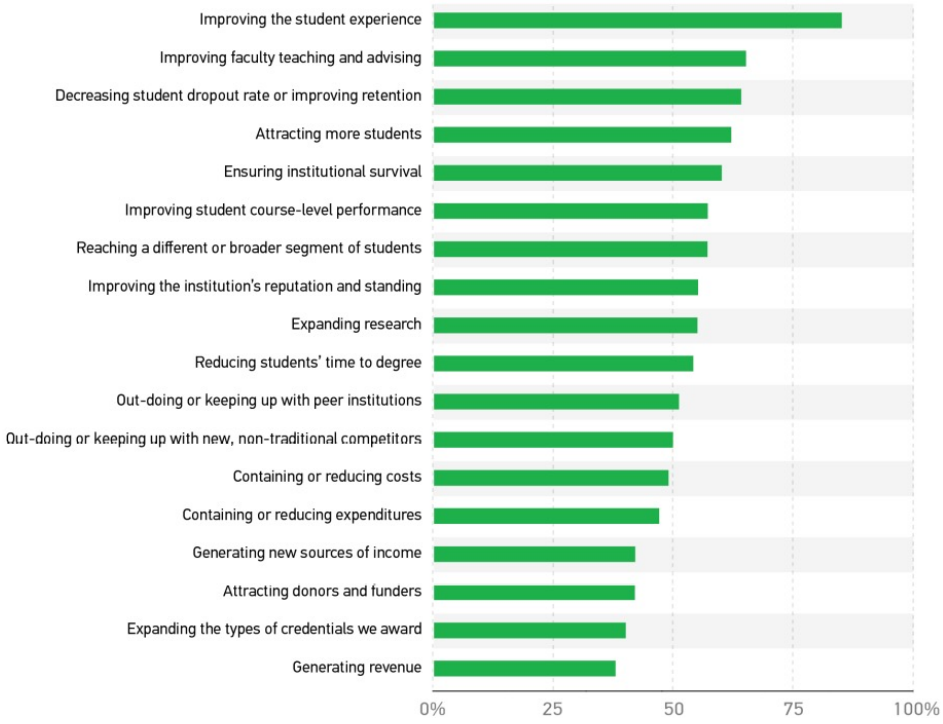
Emerging practices using technologies

Student-centered learning

The use of digital technology can support a cultural shift from teacher-centered learning to student-centered learning, and it can encourage collaboration between students and teachers as well as among students in the physical classroom and the virtual environment. One objective of the transformation in teaching and learning is to shift the focus and control from the teacher at the center to the students themselves, and to encourage students to collaborate and help enhance each other's knowledge. Student-centered learning is about spaces that provide students with the opportunity to act upon their learning needs, intentions, and interests. It encompasses the involvement of students at various stages of learning, from the selection of courses to the development of learning skills and enhancing the teacher's role. Digital forums, document multi-editing, content versioning, instant messaging, breakout rooms, and in-classroom equipment are tools that foster student-teacher and student-student collaboration. In fact, the online environment can provide opportunities for some students who prefer virtual learning to participate in discussions more. The flipped classroom—where students study a lesson outside the classroom using content provided by the teacher, such as through interactive lectures, videos, or readings—allow students to use in-classroom time for collaborative activities that require more face-to-face interaction.

By placing the students' journey at the center of higher education digital transformation, institutions will improve their positioning, financial stability, and reputation. Though digital transformation in higher education has been used to monitor and measure student performance, it is new as a methodology of teaching and learning. Through digital transformation, HEIs aim to provide education services in the most suitable and satisfactory way so that students can build the right skills and achieve good outcomes in their chosen career. Hence, digital transformation must be considered as a student-centered endeavor. In fact, the primary indicators of a successful digital transformation in higher education are related to student satisfaction and success. Brooks and McCormack (2020) researched student engagement levels in tertiary education. Figure 19 shows the importance and benefits of student engagement based on their findings:

Figure 19. Indicators of Successful Digital Transformation in Higher Education



Source: Brooks & McCormack 2020.

Innovation and Learning Platforms

A direct application of innovation in learning platforms is the use of data generated from different platforms in improving student learning and experience. Improving student learning requires more insights than can be inferred from siloed reports taken from student information systems, learning management systems (LMS), registration systems, career applications, surveys, security logs, customer relationship management or CRM system, and other systems. It also requires more flexibility than can be afforded by simple degree-planning tools or complex and expensive vendor specific ecosystems.

To help improve student success in using innovation and learning platforms, data must be gathered to track the students' user experience as they navigate the platforms and use the data to identify bottlenecks and analyze the process. The COVID-19 pandemic occasioned more and better use of the LMS, thus generating more valuable data than ever. This was not the case before 2020 when many courses were already on the LMS but HEIs were not using it for teaching and learning—only for content management. The content was there, but the students and instructors were communicating via emails or other channels.

Now, with more faculty members and students using the LMS, the richer the information it can harvest, and the better the outcomes of artificial intelligence be when applied to these data. The more courses are used on the LMS, the more data the HEIs can get, and the more insights about user needs will emerge. For the Philippines to use this opportunity, a nationwide initiative should be launched to encourage institutional data collection and build a national dataset of student outcomes that complies with data privacy regulations. Once the data are collected, different AI models can be applied to study, predict, and enhance student outcomes.

Learning management system

A well-designed LMS can provide teachers and students with a comprehensive teaching and learning platform. It can provide teachers with tools to create and deliver content, assign tasks, set up and monitor discussion forums, administer exams, and monitor and assess student participation. It provides students with

spaces to access their learning content, collaborate or discuss topics with other students, and submit their course requirements. An effective LMS must include the appropriate course shells, templates, grade books, and question banks, and should have plugins and tools that can increase engagement.

An LMS should provide three critical system capabilities: identity systems, student information systems, and SCORM (sharable content object reference model) plugins. First, it is vital that identity systems such as login details for students be the same for the LMS as for other systems such as email. Most LMS in the market have this functionality. They integrate with SAML (Security Assertion Markup Language) authentication providers, thus providing single sign-on with other systems that students use. Integrating with an identity management system will off-load the operating team from managing such tasks as activating and deactivating accounts, password resets, and troubleshooting access. All these will be managed centrally for the students and the operation will not have to be repeated in every system. Second, the integration of student information systems can occur in two ways: (i) getting registration data from the student information system and mapping students to courses based on the registration; and (ii) getting the final grades from the LMS and inputting them into the student information system. Third, plugins are among the most powerful functions outside the normal boundaries of the LMS. One of the best ways to motivate learners is to provide interactive, attractive, and stimulating content. This is where SCORMs[51] and XAPI (experience application programming interfaces) come in. For instance, SCORM content is used widely in the e-learning and online training industries to create engaging content whereby students click a link to access specific content areas, answer questions, and start/pause a narrated script.

Digital pedagogy

Digital pedagogy is a service that offers tools for instructional design, processes, multimedia production, and quality assurance—all of which can transform a course or a program to an engaging and effective digital format. Multimedia authoring tools give an integrated environment for assembling the elements of a multimedia production such as text, audio, graphics, and animation.[52] They can be used for research dissemination, university communication and marketing, and development of reusable learning objects in online courses or hybrid courses.

Digital repository is a core academic archival system that contains all the reusable learning objects that are used in courses and programs or in the libraries. Such a system provides services to store, search, and distribute content in a secure way via web or via technology channels.

Digital tools to manage administrative and academic data

Administrative services tools are used for administration and support functions. One example is an enterprise resource planning (ERP) software that links data about finance, procurement, revenues, and human resources. Other tools include communication and marketing tools to enhance the university's presence on the digital map, and collaboration and self-service tools that staff can use for working together online and benefitting from digital services. A service desk tool can provide administration-related support and troubleshooting services to students and faculty.

Academic administration tools support core teaching and learning activities and are used for record keeping and management of core academic activities such as teaching, learning, and research. These tools include a student information system (SIS), which helps the registrar and admissions department track prospective students during their application, enrollment, and registration process.

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51 SCORM is a collection of standards and specifications for e-learning. It defines communications between client-side content and a host system, which is commonly supported by an LMS. Source: Wikipedia. https://en.wikipedia.org/wiki/Sharable_Content_Object_Reference_Model. Accessed on April 28, 2022.

52 https://www.tutorialspoint.com/multimedia/multimedia_authoring.htm.

Faculty information systems (FIS) consolidate the human resources records of academic and non-academic staff. It fills the gap that traditional HR management systems do not address.

Academic support tools are used for academic support units such as registrar, admissions, and financial aid.

E-learning and distance learning

e-Learning can take place on campus, as distance learning off campus, or in a hybrid context. It is not necessarily online education, which is one form of e-learning. e-Learning integrates digital tools into the curriculum, and this can facilitate active learning. Active learning is a teaching and learning approach that engages students in the process of learning through activities and/or discussion, as opposed to passively listening to an expert. As opposed to passive learning, it emphasizes participatory approaches and strives for higher order thinking and often involves group work.

As the percentage of face-to-face in-classroom time is reduced, learning transitions from technology-assisted to fully online, passing through the following formats:

Technology-assisted delivery format - This includes all courses where the in-classroom time spent by students is equivalent to the credit hour requirements. For example, a three-credit course would require three hours of in-classroom lecture time per week over 14 weeks.

Blended delivery format - This includes all courses where the in-classroom time spent by the student is reduced but not removed. For example, a three-credit blended course would require one or two hours of classroom lecture time per week, instead of three. The remaining in-classroom lecture time is replaced by online experience.

Online delivery format – fully online, where students do not need to go to the physical classroom.

Blended and hybrid course models

As a result of the COVID-19 lockdowns, higher education has moved entirely online, as mobility restrictions have become highly disruptive to the traditional learning experience. The pandemic has also compelled higher education to adopt new hybrid models to cater to all socioeconomic levels. However, once the health risks are reduced through vaccination, higher education institutions must decide whether to keep these hybrid models, abandon them, return to more traditional models, or find some other option. Some believe that a recent breakthrough in mixed education will lead to an entirely online higher education career for students in the future. Nonetheless, some studies have shown that face-to-face lessons are more valued by students, particularly from a campus and social life perspective.

Teacher and student assessment

The effectiveness of the teacher, course, delivery format, and student learning can be assessed at the end of each course using an instructor course evaluation (ICE) process. The ICE collects student feedback about the overall teaching effectiveness, including the instructor's preparedness for classes, knowledge of the subject matter, availability to respond to questions and feedback, and ability to communicate and maintain interest in the subject matter. It also collects feedback about the effectiveness of the course, clarity of its objectives and requirements, organization and pace, availability of resources, assessments, and overall quality. If the course was offered online or blended, a part of the ICE process should assess the online experience in terms of course organization, navigation, content accessibility, variety of online activities, relevance, effectiveness of the technology tools used, interaction with the instructor, and overall online experience.

Student assessment is about measuring learning progress towards course learning objectives and giving feedback to students to improve their learning. Student assessment is not necessarily tied to exams and quizzes. It is not only about the grades or grading students. Assessment can be defined as a "process of gathering data to better understand the strengths and weaknesses of student learning" (Harris & Hodges 1995).

With distance learning comes the challenge of assessing the students' understanding and achieving course objectives. Assessments must be aligned with course outcomes. Different online assessment methods allow teachers to progressively help their students attain the course objectives from knowledge transfer to skills. Kumar (2021) identified three online assessment methods:

1. Technology-driven AI-enabled assessment
2. Digital submissions
3. Assessment submissions, such as continuous assessments, open-book assessments, open assessments, and class participation activities

It goes without saying that instructional designers should redesign the assessment methods to suit the desired online learning outcomes and the capabilities of online delivery.

Education 4.0

Education 4.0 allows learners to discover and innovate, aligns machines with the needs of learners, and combines education pedagogy with 4IR technologies. This vision of education in the future is based on leveraging the power of digital technologies, customized data, and the opportunities provided by a connected ecosystem to promote lifelong learning. The educational revolution empowers learners to be the architects of their knowledge by personalizing learning through flexible, dynamic, and adaptive learning pathways. University 4.0 builds on the requirements of Education 4.0 but adds autonomous management of learning processes to integrate the physical and digital worlds to improve and adapt the learning experience (Gueye & Exposito 2020).

Micro-evaluations

Micro-evaluations can increase the fairness of formative exams, as opposed to summative evaluations, and they can improve student engagement throughout the course. By-products of micro-evaluations include (i) the tremendous data generated, which could help in predicting and enhancing student outcomes, and (ii) the introduction of adaptive models to present the students with more or fewer resources depending on their level of understanding of topics.

Chatbots

A chatbot is a software application used to simulate conversation with human users, especially over the internet, and it is increasingly used for various processes. University of Columbia in NYC, an Ivy League university, developed Yoda, an AI personal assistant to help students with the registration process. At the University of Oklahoma, the SoonerBot, launched in May 2018, was credited for securing the largest first-year class in the school's history in 2019 (Rudra 2020). Georgia State University (GSU) saw solid results in reducing "summer melt"[53] by 22 percent within the first semester of implementing an AI-powered chatbot nicknamed "Pounce" (Gehlbach & Page 2018). That number has since grown to more than 30 percent, which has led to hundreds more students enrolling each year at GSU.

[53] Summer melt is the phenomenon of prospective college students' motivation to attend college "melting" away during the summer between the end of high school and beginning of college.

Blockchain

A blockchain provides an immutable trusted general ledger, which is best used to store official documents, such as degrees, diplomas, certificates, or transcripts of records. This public ledger automatically records and verifies transactions by using a distributed ledger technology, which no one controls, making it the foundation that powers bitcoin, ethereum, and other cryptocurrencies. In higher education, risks such as manipulation or deletion of transcripts and study records can be eliminated with the adoption of blockchain. Students' learning data could be broadcast over the network and downloaded by students or prospective employers. Employers could discover more about the students' learning status and validate the information using blockchain-based data. HEIs can collaborate to create a trusted and shared infrastructure standard for issuing, storing, displaying, and verifying academic credentials and transcripts through blockchain (Kelly 2019). The blockchain's ability to manage, share, and protect digital content makes it ideal for helping higher education stakeholders, such as researchers and academic faculty members, create intellectual property (IP), share it, and control copyrights and digital rights protection by ensuring how their IP is used.

Internet of things

IoT enables higher education institutions to analyze student data and performance, enhancing the learning journey and resulting in better outcomes. Digital campus is an example of IoT providing a critical platform for students to access information via specific locations to enhance their learning experience. Universities will reduce operational costs with a digital campus; improve data security; and provide digital tools to researchers, academics, and students. These advantages contribute significantly to the university's work, student experience, and research.

Extended reality

Extended Reality (XR) can help facilitate digital experiential learning by enabling students to learn through experience and learn from reflection by doing. XR technology can be deployed at HEIs as a strategic educational methodology for improved teaching and learning. Massachusetts Institute of Technology (MIT), for example, launched the Collaborative Learning Environments in Virtual Reality (CLEVR) project to develop VR simulations for classroom use. Healthcare, medicine, and nursing are other fields in higher education where XR technology is applied, as with the case of Morgan State University (Pomerantz 2020). The Yale Blended Reality Project has dozens of sub-projects related to energy, electronics, medical training, and archaeological discovery (Yale University 2020).

Learning Analytics

The future of learning analytics is promising, and institutions must continue to explore it while upgrading their infrastructure and technical capabilities to capture and analyze data and implement better data strategies and protocols. Universities generate more data than they can analyze, owing to a lack of strategic data planning (Pelletier et al. 2021). HEIs must remain relevant by working with vendors in utilizing data and learning analytics in their products to ensure that institutional strategic goals are achieved, and ethical standards are observed.

Learning analytics, a subset of data analytics, is the collection, measurement, analysis and reporting of data about learners and their context in order to understand and optimize learning and the learning environment. Institutions continue to develop internal systems to effectively collect, host, and use available data to understand stakeholders in the higher education sector and provide the best educational experience to students. With a focus on quantitative and qualitative outcomes, such an approach is likely to positively impact teaching, learning, and policy making.

Partnership Platform

The partnership platform could be a hub for many institutions to combine resources and consolidate digital services. As technology's capital and operational costs in higher education continue to rise, colleges and universities began to form consortiums to pool their resources together.

Quality Platform

As digitalization is transforming in-person and online education, the Philippines must adopt its version of a quality rubric for courses delivered with technology assistance—flipped, hybrid, blended, or online. To ensure that the transformation improves course quality and student engagement, faculty members and instructional designers must be guided in designing courses and improving the learning experience. Establishing a quality framework encourages better adoption of digital transformation in education.

Research

Technology has become more critical for many aspects of university functions, and research is no exception. Institutional research and information technology need to be used hand in hand for better effectiveness. IT needs to provide computation research tools such as powerful virtual workstations and high-performance computing (HPC). Moreover, survey tools should be well supported across the organization. And finally, IT should be able to streamline the processing of grant proposals, consolidate grant infrastructure, and provide better support for grant projects.

Transforming research and research tools can be enabled through research clouds (RC), either at national or institutional level. Research clouds are portals for building virtual research workspaces efficiently. They address challenges such as large-scale multitenancies (i.e., multiple applications operating in a shared IT environment) and unusual or infrequent digital resource requirements. Such research clouds will contain a set of tools and services to provide access to HPC resources: fair access if it is a national RC or dedicated access in the case of an institutional RC. For instance, a library information system (LIS) can be used as an ERP by library administrators, content management for researchers, and a repository of digital credentials for external database subscriptions within an institution. It tracks physical and digital items, provides the needed space for university-generated research or teaching content, and serves as a channel for accessing external research databases and publications. The clouds can be used for surveys too. Commonly used survey tools include instructor course evaluations, student surveys, and institutional research surveys. It is essential that the institutional review board ensure that surveys comply with privacy and data protection rules and the IT unit provide technical support for researchers.

For a successful digital transformation in research, HEIs must have the tools for handling data storage, retrieval, and transfer. As technologies such as the Internet of Things (IoT), artificial intelligence, and 3-D imaging evolve, the size and amount of data that organizations must work with are growing exponentially. The handling of research data and software is a crucial institutional service. Research data could come from different sources, such as databases, collected data, publicly available data sets, purchased data sets, IoT, and others. Research data may be stored in several formats, including structured files, unstructured text, and media files such as images, audios, and videos. Data can be of acceptable size and easily transferrable, typically less than 10 GB, or they can be big data in terabytes, especially when they contain non-text formats. Such a case is specific to research around digital image processing, genomes, and big data research.

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