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Digital Transformation in Information Systems Curricula: A Keyword Analysis

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Abstract

Modern digital technologies are advancing rapidly, driving transformative changes. For Information Systems (IS) educators, maintaining curricula that prepare graduates for the digital economy is imperative. This study developed a knowledge pool of 121 common keywords in digital transformation through literature review and investigated their application in the titles and descriptions of 4,093 IS courses across 315 undergraduate programs in the United States. The findings illustrate how IS educators conceptualize the digital transformation within the IS discipline and incorporate it into curricula. Additionally, the results offer insights for educators aiming to develop course content on digital transformation and update IS undergraduate curricula to align with the demands of modern enterprises in the era of digital transformation.

Keywords: Digital Transformation, IS curricula, IS Course Design, IS Curriculum Development

Digital Transformation in Information Systems Curricula:
A Keyword Analysis

Drew Hwang, Hui Shi and Larisa Preiser-Houy

1. INTRODUCTION

As businesses embrace new digital technologies, they require Information Systems (IS) professionals competent in designing, developing, and managing modern technologies. IS educators continuously face the challenge of assessing and updating their curricula to meet the demand for workforce-ready graduates.

A systematic literature review (Feng and Salmela, 2020) indicates consistent rigor in IS curriculum studies over the last decade. These studies are categorized as normative and descriptive (Hwang et al., 2015). Normative studies aim to identify factors affecting IS curriculum design, while descriptive studies focus on describing IS courses or programs. A common theme in descriptive studies is evaluating the state of undergraduate IS curricula, accomplished through comprehensive surveys of IS programs in countries like Canada, India, U.K. or U.S. or those affiliated with accreditation bodies such as AACSB or ABET (Kung et. al, 2006; Stefanidis and Fitzgerald, 2010; Harrington & Larson, 2012; Yang, 2012; Bandi et al., 2014 These studies provided either a descriptive snapshot of the entire IS curricula or an overall mapping to a model curricula such as IS 2010. This study takes the same approach to examine the undergraduate IS curricula in the United States, but with a focus on how its course content, defined as course title and course description, addresses digital transformation.

This paper is organized as follows: Section 2 discusses digital transformation, Section 3 explains the methodology for creating the keyword pool and IS curricula dataset, Section 4 presents the analysis of results and discussion, and Section 5 provides conclusions, limitations, and recommendations for future research.

2. DIGITAL TRANSFORMATION

Businesses have been transformed by digital technologies characterized by pervasiveness of social media, proliferation of mobile devices and apps, optimization of data value through analytics, and virtualization of computing resources in the cloud.

The convergence of social media computing, mobility computing, data analytics, and cloud computing is known as the SMAC technology stack in contemporary IT architecture. This stack has been identified as the 3rd Platform of Computing by IDC (Gens, 2013), the Nexus of Forces by Gartner (Plummer et al., 2012), and the fifth wave of corporate IT by technology futurists (Evans, 2013). In IDC's term (IDC, 2017), the 3rd platform evolution will be further fueled by the emerging innovation accelerators such as IoT, AI, robotics, AR/VR, 3D printing, and blockchain. Example applications include intelligent home appliances, self-driving cars, robots, wearables, and other applications.

Digital transformation fundamentally revolves around the digitization of analog data, the digitalization of business processes and models, and the transition from physical to digital in product and service design. Being "digital" is a key driver in the strategic planning and operation of modern organizations. In the sense of business being deliberately transformed, digital is a "mindset that seeks to leverage technology, data, and ways of working to establish new business and service models for the achievement of a higher purpose and value" (Tardieu et al, 2020).

The definitions of digital transformation vary greatly. Trying to unify the definitions, Gong and Ribiere (2020) defined digital transformation, at its highest level of abstraction, as "a fundamental change process, enabled by innovative use of digital technologies, accompanied by strategic leverage of key resources and capabilities, aiming to radically improve an entity and redefine its value proposition for its stakeholders". From a multidisciplinary perspective, the scope of digital transformation should at least include "information systems, strategic management, marketing, innovation, and operations management" (Verhoef et al., 2019). "Digital Transformation," "Business Transformation," and "Digital Business Transformation" are terms used interchangeably.

Modern organizations adopting this new fusion of technologies require IS professionals knowledgeable in helping with digital transformation. To address workforce demands, IS educators are encouraged to design and develop curricula that include digital transformation course content. This study examines how IS educators conceptualize the digital transformation phenomenon and integrate it into IS undergraduate programs in the United States by identifying and analyzing keywords used in course content.

3. METHODOLOGY

This study developed a pool of keywords related to digital transformation to analyze the course content, titles and descriptions, of undergraduate IS programs in the United States.

The Keyword Pool
Digital transformation is a relatively new field lacking a universally accepted, holistic framework (Kutzner et al., 2018; Lassnig & Klieber, 2022; Gao et. al, 2022). Without such a framework, researchers often adopt an abstract approach, conducting independent literature reviews to identify key knowledge keywords, terms, or themes for validating the sensitization and conceptualization of digital transformation (e.g., Henriette et al., 2015; Kutzner et al., 2018; Nadeem et al., 2018; Hausberg et al., 2019; Verhoef et al., 2019).

A literature review of IS/IT articles published between 2010 and 2022, containing "Digital Transformation" in titles or abstracts, was conducted to develop a keyword pool for this study. As shown in Appendix A, the review identified 121 keywords in fifteen knowledge subjects, categorized under four conceptual constructs. These keywords encapsulate the nature, essence, and uniqueness of digital transformation.

In summary (knowledge subjects italicized and conceptual constructs highlighted in bold), digital transformation, driven by a **digital platform**, fosters *digital generativity*, allowing the addition of new capabilities post-design and production. Such a platform facilitates a highly *heterogeneous* mix of social networks, mobile devices, and cloud infrastructures, ensuring real-time, ubiquitous *digital connectivity*. Employing modern *digital software engineering* practices, **digital systems** in this transformation use *software-defined infrastruc*ture, adopt *service-oriented computing*, enhance *digital user e*xperience, and enforce *digital security*.

Digital transformation brings *digital effects* in which data is massively digitized, the physical materialization is turning to digital materialization in product design, and business processes and models are being digitalized. Consequently, vast **digital data** is generated and stored in the cloud, maximizing its value through *data analytics*. Success in digital transformation necessitates proficient **digital management**, guided by *transformative IT leadership*, fostering *digital strategies, digital technology convergence*, and *digital innovation*, ultimately evolving an organization into a *software-driven enterprise* or *digital business.*

The IS Course Dataset
To ensure consistency, this study focused on business and management schools, which are the typical contexts for IS undergraduate education. These schools generally require students to complete predefined business courses along with a fixed set of core courses or common core courses and electives in one or more specialization areas.

The study first compiled a list of 771 business and management schools in the U.S., including accredited, non-accredited, public, and private institutions, as listed in univsource.com, wikipedia.com, allBusinessSchools.com, and other websites. Out of these schools, 335 IS-related programs such as Information Systems, Computer Information Systems, Business Information Systems, Management Information Systems, and so on were identified. A content review of each program's website and/or online catalog was then conducted from June 2022 to March 2023, identifying 4093 IS courses.

Data, including course catalog number, title, and description, were compiled into an Excel worksheet for categorization, analysis, and summarization. This worksheet was also converted into a Microsoft SQL Server table for further course content analysis.

4. RESULTS AND DISCUSSION

To gain a deeper understanding on how IS educators conceptualize digital transformation phenomenon within the IS discipline and its integration into curricula, this study tallied occurrences of 121 digital transformation keywords in titles and descriptions of the 4093 IS courses. Categorized by the four digital transformation constructs, 75 keywords that appear at least once in the IS course titles and/or descriptions are listed in Appendix B.

Digital Transformation as a Keyword
This study first observed the usage of three forms of digital transformation keywords: "Digital Transformation," "Business Transformation," and "Digital Business Transformation" in course content. Despite calls to teach Digital Transformation as a standalone course in higher education (Moreira et al., 2017; Dang & Vartiainen, 2022), only two such courses were found in IS curricula: *Digital Business Transformation* and *Technology-Enabled Business Transformation*.

As detailed in Appendix C, these courses emphasize the importance of "alignment of process, people, and technology" to "support and innovate business strategies," and teach students "a managerial understanding of applications, emerging technologies, skills sets, business concepts, and strategic opportunities that organizations need to master in order to plan, manage, and lead companies through the process of digital business transformation". Although these two courses do not cover all aspects of Digital Transformation, they are indeed courses that teach Digital Transformation.

Though the three digital transformation keywords feature only in two course titles, they are present in descriptions of six additional courses: *Management of Technology and Innovation, Business Dynamics, Enterprise & Supply Chain Management Systems, Management of Information Systems, Business Process Automation,* and *Design Thinking*. These courses, as per their descriptions, acknowledge the rapid and competitive evolution of today's business landscape, fueled by transformative technologies, and each addresses challenges from a particular perspective of digital transformation:

- The *Strategic Management of Technology and Innovation* course recognizes the innovative nature of digital technologies and teaches students how to apply the technologies to create innovative digital experiences, products, and services.
- Knowing the impact of digital technologies on business processes, the *Business Process Automation* course shows students how mapping and automating business processes can improve digital transformation.
- The *Management of Information Systems* course seems to be a traditional Management Information Systems (MIS) foundation course but with a focus on the role of IS managers in digital transformation.
- In the *Design Thinking* course, students learn how to design or re-design existing products,

services, and business models for digital transformation.
- The *Business Dynamics* course introduces the "systems thinking" approach to master the complexity in Digital Transformation.
- Emphasizing the importance of process integration within an enterprise, the *Enterprise & Supply Chain Management Systems* course focuses on digital transformation occurring within the firm and across the firm's supply chain.

Transformation as a Keyword
Attention was also given to "Transformation" as a standalone keyword with a broader scope to understand if Digital Transformation is conceptualized differently in this IS curricula dataset. Results showed that this keyword appears in one course title: *Enterprise Strategies and Transformations* (see Appendix C). Although the course emphasizes "integrative strategies spanning all business functions" for evolving enterprises, it does not explicitly state the concept of digital transformation in the description.

At the same time, "Transformation" appears 22 times in course descriptions other than those discussed above. A review of these descriptions reveals that "Transformation" is mostly used in the context of Data Warehousing, where it is an element of the data extraction, transformation, and loading (ETL) process. Other instances illustrate the process of raw data being transformed into information for data analytics in subjects such as Data Management and Business Intelligence. This usage does not principally refer to digital transformation.

However, two courses are found to teach digital transformation but use only the keyword "Transformation" in the course description. One course, *E-Commerce*, teaches "the transformation of businesses to be technologically competitive in the 21st century" using "major software systems like customer relationship management, supply chain management, big data, cloud technologies, and the Internet of Things". Another course*, IT Strategy: Disrupting Norms*, emphasizes "managerial and industry issues with a focus on the transformations of business models" due to technological disruption.

Digital as a Keyword
The core concept of digital transformation is "Digital". The origins of the word "digital" date back to late 15th century (Holden, 2023), but its usage became more widespread as a direct result

of modern computing in the twenty-first century. Today, the word "Digital" is used in conjunction with many other words to convey a concept or subject using binary digits (Digital, 2023). As shown in Table 1, the study found that the keyword "Digital" is associated with 16 other words in 34 course titles. A review of these course descriptions reveals the following facts:

Digital Enterprise	Digital Commerce
Digital Business	Digital Economy
Digital Entrepreneurship	Digital Marketing
Digital Innovation	Digital Market
Digital Services	Digital Security
Digital Product Management	Digital Forensics
Digital Business Design	Digital Analytics
Digital Solutions	Digital Media

Table 1 "Digital" in Course Titles

- Several courses recognize the fact that businesses in the digital transformation era are operating in the digital environment such as the digital market (e.g., *Data-Driven Decisions in Digital Markets*), the digital commerce (i.e., *Digital Commerce and IoT Analytics*), or digital economy (i.e., *Analytics and the Digital Economy*).
- A few courses refer to businesses that leverage digital technologies as digital business (e.g., *Global Perspectives on Digital Business*) or digital enterprise (e.g., *Foundations of the Digital Enterprise*).
- Three courses, *Digital Entrepreneurship*, *Digital Entrepreneurship and Innovation*, and *Managing Digital Services and Innovation*, bring together the state-of-the-art knowledge in digital business practices using innovative digital technologies.
- Several courses refer to the agile methodology for digital transformation - the *Digital Product Management* course teaches project management for digital projects, the *Analysis and Design of Digital Solutions* course focuses on the development of digital solutions, and the *Digital Solutions with AI* course further discusses the solutions with the use of AI.
- Based on its description, the *Digital Business Design* course teaches digital transformation to a large extend in that the students "bring together knowledge of digital technologies and their skills in business design and development to create innovative, leading-edge processes, products, and services for today's modern organizations".
- Among 264 courses that contains the word Security or Cybersecurity in this curricula dataset, there is only one course titled *Digital Security*. The description of such course,

however, does not explicitly address the new and higher level of security risks created by digital transformation (Shahim, 2021).
- Even though the terms Computer Forensics and Digital Forensics are often used interchangeably, the *Digital Forensics* courses cover a broader range of examination and analysis of not only computers but also mobile devices and digital networks that expand security surface in digital transformation.

Keywords in the Four Constructs
As shown in Appendix B, most of the keywords with the highest number of occurrences appear in the Digital Data construct (56.7%), followed by the Digital Systems (27.8%), Digital Platform (11.1%), and Digital Management (4.4%). This indicates that a large amount of digital transformation context in this IS curricula dataset covers the Analytics pillar of the SMAC technology stack. This finding also corresponds to the most common pattern of the SMAC convergence (Meegan et al., 2013; Niu, et al., 2021) in which mobile devices serve as front-end platform, social networks add a layer of rich information, cloud services provide underlying infrastructure, and most importantly, data analytics enables business to reach its goal of making intelligent data-informed decisions.

Digital Platform
In the Digital Platform construct, the Social, Mobile, and Cloud technologies of the SMAC stack receive a lot of attentions in the course context. Among them, the Cloud keywords (i.e., *Cloud Computing*, *Cloud Service*, *Software as a Service*, *Cloud Security*, *Cloud Technology*, *Cloud Deployment*, *Infrastructure as a Service*, *Platform as a Service*, *Software-Defined Network*) appear the most. Thus, IS educators might also recognize the fact that the efficacy of the three digital transformation drivers, the social solutions (email and social media), the Big Data solutions (data backup and storage), and the mobile apps, are all heavily dependent on the cloud provisions (Gens, 2013).

Digital Data
Digital data and analytics receive most attention from IS educators. In Digital Data construct, three common keywords of Business Analytics, Business Intelligence, and Data Analytics are generally used interchangeably. Analysis of course data shows that these keywords are typically used in title of survey courses including (number of occurrences in parentheses) Business Analytics (95), Business Intelligence (89), and Data Analytics (47). Keywords in more specialized

areas, such as Big Data (33), Machine Learning (14), Social Media Analytics (4), and Text Mining (3), also appear in a number of course titles. Although the origin of Data Mining (51) and Data Warehousing (23) dates to the late 1980s, it is recent digital transformation movement that appears to amplify its importance and popularity because of more open, flexible, and cost-effective technologies, such as IoT and AI, that employ more advanced statistical algorithms.

Digital Systems

There are some interesting findings in the Digital Systems construct. First, Web APIs and Web Services are found, not surprisingly, to be taught in the IS programs to meet the two major implementation demands of the Service-Oriented Architecture (SOA) which is being recognized as one of the key enablers of digital transformation (Gedela & Valurouthu, 2016; Fischer et al., 2020). However, in this curricula dataset, the emerging Microservices have not yet been explicitly integrated into any IS course.

Second, software engineers in the digital transformation era face the challenge of being more agile and responsive (Rigby et al., 2016; Paterek, 2018). As found in 10 course titles, Agile Methodology is now being taught not as a module in the traditional System Analysis and Design course but solely in standalone courses including, for example, *Software Development with Agile Methodologies*, *Agile Web Design & Development*, *Agile Project Management*, *Agile Application Development*, and *Agile Principles of Software*.

Third, Python for its versatility is heavily used in the industry not only for website and software development but also for data analytics, data visualization, and software-defined networks. Python as a keyword appears 116 times with 10 occurrences in the course titles. In contrast R, as another programming language for statistical calculation and data visualization, appears only in one course title as "Introduction to R for Analytics". Interestingly, neither Python nor R have taken over the de facto Java which appears 154 times in course content with 88 occurrences in course titles.

Finally, Artificial Intelligence, once a sub-discipline in Computer Science but now a crucial technology enabler for digital transformation, appears 33 times in the course content with 5 in the course titles such as *Artificial Intelligence Application in Business*, *Business analytics & AI*, *Artificial Intelligence in Business*, *Topics in Information Systems: Digital Solutions with AI*, and *Artificial Intelligence Business Strategies and Applications*.

Digital Management

Because successful digital transformation requires the development of new software, every business could become a digital business largely controlled by software (Holmes, 2019). From the literature review conducted in this study, the business engaging with digital transformation is commonly called Digital Business or Digital Enterprise. In this course dataset, Digital Business or Digital Enterprise appears 14 times in the course context with 6 in course titles such as *Global Perspectives on Digital Business*, *Digital Business Technologies*, *Digital Business Transformation*, *Digital Business Design*, *Digital Business Lab Design*, and *Foundations of the Digital Enterprise*.

The keyword Digital Technology was also found in use 10 times in course descriptions and 3 times in the course titles including *Digital Technology*, *Digital Technologies for Business*, and *Digital Technologies: Strategy and Use*. The digital technologies being employed in digital transformation would be described more accurately as "digital" rather than "informational". However, it remains to be seen whether the use of Information Technology as an umbrella term in IS curricula (Leidig & Salmela, 2022) would be largely replaced by Digital Technology.

In digital transformation, digital technologies expand their digital capabilities beyond internal dimensions from redefining products and services to reengineering business process and models to create disruptive innovations (Ciriello et al., 2018). Digital Innovation appears in thirteen course titles including *Digital Innovation*, *Global Digital Innovation*, *Management of Digital Innovation*, *Digital Entrepreneurship and Innovation*, *Managing Digital Services*, *IS Innovation and New Technologies*, and other titles.

The keywords in the Digital Management construct appear the least. Thus, the course content in this curricula dataset reflects that IS educators might consider digital management as less critical than the digital technology itself. In the long run, however, mismanaged digital transformation might contribute to the failure of digital transformation (Baskin, 2018; Tardieu et al., 2020; Ramesh & Delen, 2021).

5. CONCLUSIONS, LIMITATIONS, AND RECOMMENDATIONS

With proliferation of innovative digital technologies, modern organizations are increasingly embedding technology across their business processes and integrating them into products and services to drive fundamental change for organizational improvements and redefining their "value" proposition. This rapid assimilation of digital technologies in different business contexts has necessitated a corresponding evolution in Information Systems (IS) education.

To explore the coverage of digital transformation content in IS curricula, this study developed a knowledge domain of 121 common keywords on digital transformation and used the keywords domain as a lens for a descriptive analysis of titles and course descriptions of 4,093 Information Systems courses in 315 Information Systems undergraduate programs in the United States.

The study's results illuminate a critical gap between the need for digital transformation competencies in the workforce and the current state of IS curricula. Despite a pervasive use of the term "digital," a granular application of digital transformation principles in course content is often lacking.

The prevalence of analytics-focused content underscores the priority given to data-driven decision-making in the curriculum, yet there is an evident need for a more integrated approach that encompasses the entire SMAC (Social, Mobile, Analytics, Cloud) stack and aligns with modern business infrastructures.

Given the low representation of digital management concepts, IS curricula should integrate more content that addresses the strategic aspects of digital transformation, preparing graduates to lead and manage change in digital-centric businesses. More specifically, to ensure comprehensive curricula coverage, educators should introduce courses that cover the managerial aspects of digital transformation, such as change management, digital strategy, and innovation leadership. They should also incorporate practical case studies and capstone projects to help students understand the real-world implications of managing digital transitions within organizations. Furthermore, encouraging an interdisciplinary collaboration with business, technology, and design disciplines can foster a holistic understanding of digital management.

Limitations of the Research
This study has several limitations. Firstly, to ensure consistency, it focuses exclusively on business and management schools that adhere to a traditional educational setting, requiring students to complete a standard set of business courses, alongside core classes and electives within certain specializations. This focus excludes coverage of digital transformation in alternative settings such as Schools of Information Technology, and departments of Information Science or Computer Science. Secondly, the lack of a universally recognized framework for digital transformation means that the analysis of course content is based on the authors' interpretations derived from their literature review. Lastly, the study recognizes the potential discrepancy between course titles and descriptions and the actual material delivered by Information Systems educators, which may be attributed to delays in updating curriculum catalogs.

Recommendations for Curricula Development
Recommendations for curricular development include the compliance with IS2020 Model Curricula, and the alignment with accreditation standards.

Future curriculum development should be benchmarked against the IS2020 Model Curricula to ensure the inclusion of essential competencies for digital transformation, emphasizing an agile, technology-fluent mindset. For example, courses should be designed or updated to map directly to the competencies outlined in the IS2020 Model, ensuring that each course contributes to the development of a specified skill set. The updated curricula should also emphasize agility and flexibility in technology use, reflecting the rapid evolution of digital tools and platforms in the business world. Furthermore, regular assessments of curricula against the IS2020 Model guidelines should be implemented with feedback loops allowing for continuous improvement.

For schools seeking or renewing AACSB accreditation, there is an imperative to align IS curricula with standards that mandate the delivery of contemporary, technology-forward content to ensure learner success in the digital economy. To that end, it is recommended that educators benchmark their curricula against AACSB standards, particularly Standard 4, to ensure the content remains current and relevant. Programs can also use accreditation reviews as a feedback mechanism to highlight strengths and address areas for improvement in digital

transformation education. Finally, schools should invest in faculty development programs on the latest digital transformation practices and pedagogical approaches.

Recommendations for Future Research
Digital transformation is a relatively new field of research with only a few studies focusing on IS curricula. One area of future research is to examine digital transformation in IS curricula through the lens of the new IS2020 Model Curricula. The new competency based IS2020 curriculum guidelines define 10 required and 9 optional competency areas, for a total of 19 areas of competency for IS education (Leidig & Salmela, 2022). Future studies could examine the occurrences of digital transformation keywords across required and optional competency domains to provide insights for curricular updates in the context of the IS2020 Model Curricula.

Another avenue for future research is to investigate how AACSB accreditation influences the integration of digital transformation in IS curricula, providing a framework for curricular excellence in digital competencies. AACSB accreditation is a rigorous, external peer-review process that ascertains curricular and programmatic quality of business schools. With the new 2020 AACSB standard for Learner Success (Standard 4. Curriculum), business schools are expected to deliver curricular content that is current, relevant, forward-looking, and aligned with program competency goals (AACSB, 2022). More specifically, Standard 4 addresses the need for learners to be agile with current technologies and possess technological agility for workforce readiness in a digital transformation era. Future research should assess whether AACSB accreditation correlates with a higher quality of digital transformation content and better student outcomes. Future studies could also identify innovative curricular practices from AACSB-accredited programs that could serve as benchmarks for other institutions.

Finally, it is recommended to extend keyword analysis to explore the presence and depth of digital transformation content in IS graduate programs, including MBA curricula, to inform the development of programs that produce leaders adept at driving digital innovation. More specifically, future studies could: 1) evaluate how deeply digital transformation is embedded in graduate IS and MBA programs, particularly in areas like strategic planning and digital leadership, 2) investigate how graduate programs differentiate themselves by integrating digital transformation and which approaches are most

effective in preparing leaders, and 3) conduct longitudinal analysis to track the career progression of graduates from programs with strong digital transformation elements in order to assess the long-term impact of graduate education.

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Appendix A
List of Digital Transformation Constructs, Subjects, and Keywords

Digital Transformation Constructs and Subjects			
Digital Platform	**Digital Systems**	**Digital Data**	**Digital Management**
Digital Heterogeneity	Digital Security	Data Analytics	Digital Business
Digital Connectivity	Digital Software Engineering	Digital Effect	Digital Strategy
Generative Technology	Digital User Experience		Digital Technology
	Service-Oriented Computing		Convergence
	Software-defined		Digital Innovation
	Infrastructure		Transformational IT
			Leadership
			Software-driven Enterprise

Digital Transformation Keywords in Alphabetical Order			
Agile methodology	Data Mining	Digital process automation	Network effect
Agile project management	Data Science	Digital security	No-Code development
Agile software development	Data Warehouse	Digital Software Engineering	Platform as a Service
Amazon Web Services	Data Warehousing	Digital strategy	Process automation
Application as a Service	Democratization of	Digital system	Process mining
Web API	technology	Digital technology	Python
Artificial Intelligence	DevOps	Digital Transformation	R
Augmented Reality	Digital age	Digital user experience	Rapid Application
Big Data	Digital application	Digital velocity	Development
Blockchain	Digital business	Digital veracity	Service broker
Bring Your Own Device	Digital Business	Digital volatility	Service-Oriented Architecture
Business Analytics	Transformation	Digitalization	Service-Oriented Computing
Business Intelligence	Digital company	Digitization	Social Computing
Business Process	Digital connectivity	Disruptive innovation	Social media analytics
Automation	Digital convergence	Enterprise application	Social network
Business Process	Digital data	services	Social network monitoring
Reengineering	Digital devices	Enterprise Data Architecture	Social network security
Change management	Disruptive Technology	Generation D	Software as a Service
Citizen developer	Digital economy	Generative technology	Software-Defined
Citizen Development	Digital ecosystem	Infrastructure as a Service	Infrastructure
Cloud Computing	Digital effect	Innovative business model	Software-Defined Network
Cloud data platform	Digital engineering	Innovative business process	Software-Defined Storage
Cloud deployment	digital environment	Internet of Things	Software-driven enterprise
Cloud security	Digital Generation	Internetification	Software-driven service
Cloud services	Digital generativity	Low-code Development	Text mining
Cloud technology	Digital Heterogeneity	Machine Learning	Transformational IT
Cloud transformation	Digital infrastructure	Master Data Management	leadership
Collective intimacy	Digital innovation	Materialization	Transformational leadership
Consumerization of IT	Digital marketing channels	Microservices	Transformation management
Customer centric	Digital maturity	Mobile Computing	Virtual Reality
Customer intelligence	Digital mobility	Mobile security	Web Services
Data Analytics	Digital modernization	Mobile technology	
Data Lake	Digital platform	Natural Language Processing	

Appendix B
Keyword Occurrences by Keyword Constructs

Digital Platform	A[1]	T[2]	Digital Data	A	T	Digital Systems	A	T	Digital Management	A	T
Cloud Computing	73	21	Business Intelligence	203	89	Python	116	31	Change management	14	
Social Media	52	14	Business Analytics	187	95	Application Programming Interface	92		Digital Technology	13	5
Blockchain	26	10	Data Mining	181	51	Mobile App	91		Digital Business	11	3
Social Network	20		Data Warehousing	137	23	Agile Methodology	60	10	Digital Solution	6	
Cloud Service	8		Data Analytics	132	47	Amazon Web Service	46		Digital Transformation	6	3
Mobile Computing	7		Big Data	105	33	Artificial Intelligence	34	4	Digital Innovation	5	2
Software as a Service	7		Machine Learning	59	14	Web Service	32		Business Transformation	5	2
Cloud Security	4		Data Science	34	13	R Language	20	1	Business Process Engineering Process Automation	4	1
Mobile Technology	3		Neural network	22		Internet of Things	16		Digital Enterprise	3	
Cloud Technology	2		Text Mining	19	3	Rapid Application Development	11	1	Digital Economy	2	
Digital Device	2		Social Media Analytics	9	4	Service-Oriented Architecture	5		Business Process Automation	2	
Digital Platform	2		Digital Data	3		DevOps	4		Digital Strategy	2	
Digital Security	2		Digitization	2		Natural Language Processing	3		Digital age	1	
Cloud Deployment	1		Master Data Management	2		Low-code development	3		Customer Centric	1	
Infrastructure as a Service	1		Google Analytics	1		Digital Product Management	1		Network Effect	1	1
Mobile Security	1		Data Lake	1		Augmented Reality	1		Process Mining	1	
Platform as a Service	1		Digitalization			Digital Application	1		Bring Your Own Device	1	
Social Computing	1					Virtual Reality	1		Process Mining	1	
Software-Defined Network	1								Digital Business Transformation		
Digital network											
215 (11.1%)			**1099 (56.7%)**			**584 (27.8%)**			**86 (4.4%)**		

[1] Total number of occurrences in both course title and course description   [2] Total number of occurrences in course title

Appendix C
Courses with Digital Transformation in the Description

Digital Business Transformation: Recent advances in computers, information and communication technologies have created new global electronic trading and communication infrastructure that affects organizational strategies, market structures, and industrial organization around the world. Managers need deep understanding of twenty-first century business models and how to align new technology with changing business processes and new ways of organizing businesses in the digital age. This course provides a managerial understanding of applications, emerging technologies, skills sets, business concepts, and strategic opportunities that organizations need to master in order to plan, manage, and lead companies through the process of digital business transformation.

Technology-Enabled Business Transformation: It does not matter(;) it's what you do with it! Business in the 21st century runs on it. However, competitive advantage seldom comes from having exclusive or proprietary access to a technology. Rather, it comes from more effectively utilizing technologies to which everyone - including the competition - has access. The implications of this reality are many. First, it is necessary to understand what technologies are available in the marketplace and their capabilities. Next, and far more challenging, it is necessary to understand how these capabilities may positively (or negatively) interact with business strategy. Business transformation is the alignment of process, people, and technology such that it can both support and innovate business strategies. Given that technologies evolve and develop at a rapid pace, it is necessary for managers to understand what technologies can do (both established and new) and how it can be leveraged to create real value.

Strategic Management of Technology and Innovation: Provide students with concepts and frameworks for identifying, assessing, creating, and managing technology-enabled innovation in organizations. Include innovation process, the framework to identify, assess, create, and implement innovation in organizations, digital transformation of organizations, managing changes, and tools for prototyping. Through projects, learn how to apply technologies to create innovative digital experiences, products, and services.

Business Process Automation: Students map current business processes and identify areas for software automation utilizing Excel VBA; how mapping and automating business processes can improve an organization by providing for simplified workflow, digital transformation of existing processes, increased service quality, improved service delivery, or reduced costs.

Management of Information Systems: Roles of information systems managers and executives in digital transformation for business processes and outcomes. Strategy and techniques in development and deployment of information systems for sustainable competitive advantage. Ethical, organizational, social opportunities and challenges inherent in information systems management.

Business Dynamics: Managers and business leaders need to make sense of a complex and fast-changing business landscape. They need to map, analyze, and manage complexity to achieve superior performance. This course introduces systems thinking, as well as associated modeling methods, techniques, and software tools that are essential to master complexity and drive business performance. The course explores models, model-based thinking, complex system dynamics, network dynamics, and other computational modeling approaches. These skills can be used to understand system structure and dynamic behavior across a variety of business domains and applications, including business transformation, digital transformation, business model design, and sustainability. Case studies across a variety of industries and a group project add to the student learning experience.

Design Thinking: Design thinking refers to a transformation and problem-solving approach that emphasizes strong user orientation and agile iterations with multidisciplinary teams. Aiming to create ideas and solutions that are emotionally meaningful, functional, and economically viable, "design thinking integrates the needs of people, the possibilities of technology, and the requirements for business success ." Design thinking is applicable to both start-ups and mature organizations to design new offerings or re-design existing teams, products, services, business models, or platform ecosystems. Adopting a hands-on and experience-based learning approach, this course introduces design thinking to business undergraduate students. Through lectures and case discussions students will learn about the design thinking process and the applications of design thinking for digital transformation across a variety of industries. Students will also work in teams to participate in a design challenge project.

Enterprise & Supply Chain Management Systems: This course emphasizes the importance of integration of processes within an enterprises and across enterprises in a supply chain and the systems used to support these processes. Enterprise systems support the internal logistics chain within a firm integrating processes across all functions. Students will learn about the digital transformation taking place within the firm and across the firm's supply chain. The course will introduce students to processes and systems that firms use to harness the capabilities of their supply chain partners and supply networks.

Enterprise Strategies and Transformations: Organizational transformations are critical for continued market success in an increasingly complex and dynamic global environment. Emphasizes integrative strategies spanning all business functions which are needed by evolving and established enterprises.