Journal of Information Systems Education

Volume 35
Issue 2
Spring 2024

Fintech and Digital Payments: Developing a Domain Knowledge Framework

Saurabh Gupta, Ying Xie, and Humayun Zafar

Recommended Citation: Gupta, S., Xie, Y., & Zafar, H. (2024). Fintech and Digital Payments: Developing a Domain Knowledge Framework. *Journal of Information Systems Education*, 35(2), 189-202. https://doi.org/10.62273/HIGA9274

Article Link: https://jise.org/Volume35/n2/JISE2024v35n2pp189-202.html

Received: April 5, 2023
First Decision: August 3, 2023
Accepted: September 16, 2023
Published: June 15, 2024

ISSN: 2574-3872 (Online) 1055-3096 (Print)

Journal of Information Systems Education, 35(2), 189-202, Spring 2024
https://doi.org/10.62273/HIGA9274

Fintech and Digital Payments: Developing a Domain Knowledge Framework

Saurabh Gupta
Department of Information Systems and Security
Kennesaw State University
Kennesaw, GA 30144, USA
sgupta7@kennesaw.edu

Ying Xie
Department of Information Technology
Kennesaw State University
Kennesaw, GA 30144, USA
yxie2@kennesaw.edu

Humayun Zafar
Department of Information Systems and Security
Kennesaw State University
Kennesaw, GA 30144, USA
hzafar@kennesaw.edu

ABSTRACT

Financial technology (fintech) is a rapidly evolving industry. As in any high-growth industry, a significant challenge is the acquisition of top talent, especially university graduates. However, most experts in this field have not been formally trained in an academic environment. Degrees in Fintech did not exist until recently. In this study, we developed a fintech domain knowledge framework for digital payments to facilitate the creation of higher education programs that address the gap in the fintech talent pool. We posited that the proposed domain knowledge provides opportunities for higher education to initiate degree programs. In this study, we review the fintech space and focus the proposed framework on the largest fintech cluster—digital payments.

Keywords: Fintech, Fintech talent, Digital payments, Knowledge framework

1. INTRODUCTION

The global financial technology (fintech) market is expected to grow sixfold, from $110 billion in 2020 to $698 billion in 2030, a compounded annual growth of 20% (Allied Market Research, 2021). This study developed a domain knowledge framework for this space. Emerging on the Internet and Web, fintech has driven a fundamental change in the financial sector of our economy (Gobble, 2018), especially since the launch of PayPal in 1998. Its massive connectivity, almost universal mobile accessibility, exponentially increasing computational capabilities that confirm Moore's law, and the progress in artificial intelligence since its turn toward deep learning have reinforced and underwritten the "Fintech Revolution" (Zwass, 2018). The adoption of fintech services has moved steadily upward, from 16% in 2015, when the first Fintech Adoption Index was published, to 33% in 2017, and to 64% in 2019. The awareness of fintech, even among nonadopters, has become extremely high. For example, 96% of consumers worldwide know of at least one alternative fintech service that is available to help them transfer money and make payments (E&Y, 2019).

Overall market investment and innovation in fintech continues to increase, amounting to over $150.4 billion of new investment since 2018. It is worth noting that fintech and traditional financing are not mutually exclusive, and therefore, the former should not be considered a replacement for the latter (Anifa et al., 2022). However, fintech has been used to resolve several complex issues that could be considered barriers to the accessibility of financial products. The synergy of fintech power and traditional finance methods has improved cash flow and positive growth, especially during COVID-19 (Rabbani et al., 2021; Zhang et al., 2022). Corporate organizations have doubled their innovative digital banking trends, including "no-touch" or "contactless" payments and other fintech-related services (KPMG, 2020). In Georgia, the fintech space now includes 170 companies, and the top 15 public companies have reported $114 billion in revenue. Georgia's fintech employment

has been reported to account for 53% of new opportunities between 2013 and 2020 (TAGonline, 2020).

As shown in Figure 1, fintech segments can be categorized into six clusters (Art & Senn 2017; Chishti et al., 2020; KPMG, 2020; WEF, 2015):

- Paytech or digital payments
- Insurtech or insurance
- Regtech, including banking and lending regulations
- Wealthtech or investing
- Distributed ledger technology (blockchain)/cryptocurrency
- Cybersecurity

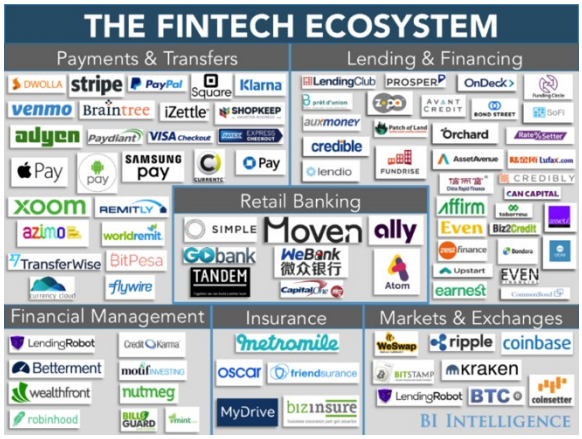


Figure 1. The Fintech Landscape (Das, 2019)

Paytech and digital payments represent the largest share of all these clusters combined. Some experts have argued that its share is as high as 60% of the overall fintech space. Because of their predominance, the subsequent sections focus on digital payments.

Since the dotcom boom in the 1990s, there has been a constant stream of innovation and growth in the digital payment cluster. The noncash (i.e., digital) payments fintech cluster in the US has increased significantly from 5.1% (2012–2015) to 6.7% (2015–2018), a $30.6 billion increase (Figure 2). In terms of value, growth was pegged at 3.8%, increasing during the same period (Figure 3).

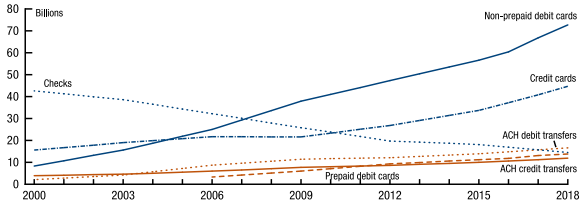


Figure 2. Trends in Noncash Payments by Number From 2000–2018 (Federal Reserve, 2019)

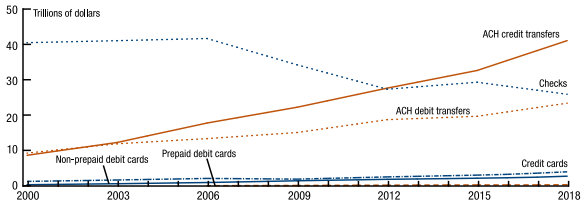


Figure 3. Trends in Noncash Payments by Value From 2000–2018 (Federal Reserve, 2019)

In both indicators, the growth rate further increased during the onset of the global COVID-19 pandemic in 2020 as consumers traded safety for convenience during quarantines and lockdowns, which accelerated digital commerce. Access to goods and services through contactless payments was no longer optional in many cases, as order-ahead and curbside pickup replaced dining-out and window shopping, also increasing the adoption of digital payments and Paytech (KPMG, 2020). Additionally, the post-COVID adoption of digital payments has not been restricted to the tech-savvy generation, but has increased across all age groups (Capgemini, 2020) (Figure 4).

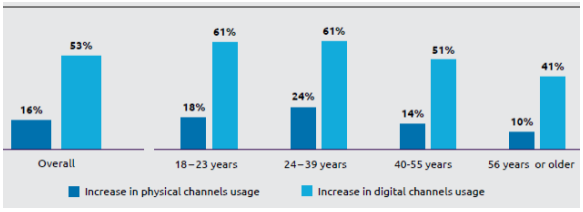


Figure 4. Adoption of Digital Payments Across Age Groups

The exponential growth of consumer digital payments is indicated in an analysis of Visa's transaction volume, in which "Visa estimates" of "around $17.5 trillion of consumer cash transactions conversion opportunity globally" were found in 2021 for the largest player in digital consumer payments (Capgemini, 2020). Such growth in usage has been combined with that in the number of new firms and new business models in the last decade. While the earliest traces of digital payments can be traced to Western Union's 1871 money transfer between branches, the democratization of payment technologies into consumer wearables, as well as emerging technological and regulatory standards around payments, has yielded consumer-to-business, business-to-business, and consumer-to-consumer channels of operations. This has led to an increasing number of fresh players in this market, including the growth of niche payment technology companies in healthcare and cross-border payments (KPMG, 2020). The digital payment ecosystem encompasses the domains of both consumer payments and money movement. Consumer payments encompass all B2B, C2B, and blockchain-supported commerce. Money movement includes wholesale payments, Bank-2-Bank movement of funds, Central Bank money movement, SWIFT rails, and the Federal Reserve's efforts in real-time payments.

While the above market analysis points to vast opportunities for graduates, the current taxonomy and classification system used by the Bureau of Labor Statistics does not adequately capture this demand. These jobs are

classified in one of two areas: 1) jobs that involve technical components are classified under Science, Technology, Engineering, and Mathematics (STEM) classifications, such as information systems and information technology (SIC code 11-3000); 2) if they are titled to indicate the execution of a payment service, they are classified as financial services (SIC code 13-2000) (BLS, 2018). Thus, no accurate numbers can be determined.

Despite this limitation, an analysis of both Standard Industrial Classification (SIC) codes showed tremendous growth in both areas (BLS, 2018). This, coupled with explosive growth in the industry, shows tremendous potential for graduates in the fintech space. We contend that since digital payments represent the largest share of fintech, this sector represents the largest growth potential.

2. THE DIGITAL PAYMENTS/PAYTECH EDUCATION SPACE

In 2021, there were two dominant outlets for digital payments and paytech education: industry/trade associations and corporate environments, both of which provided valuable information to new professionals entering the paytech space. However, this structure was far from inclusive because current opportunities for paytech education existed only for those already employed in the industry and those who had access to corporate internships and training.

2.1 Trade Associations

Trade associations, industry trade groups, and industry bodies are organizations founded and funded by businesses operating in a specific industry. Consequently, their primary interest is in servicing a narrow sector that includes their own members.

The dominant trade association in this area is the Electronic Transactions Association (ETA), which initiated the Certified Payments Professionals program in 2011 (http://electran.org). The stated purpose of the program was to "raise the level of professionalism" among independent sales organizations and other salespeople in the payments industry (Green Sheet, 2014). However, recently, the focus of the program has broadened to include not only sales but also the following: pricing and interchange; business processes, operations, and workflow; products and solutions; risk; and regulatory, compliance, and security matters. Other trade associations related to the payments space, such as the Merchant Risk Council (MRC) (https://www.merchantriskcouncil.org/) seek to educate their members by offering ongoing webinars, white papers, and conferences. The MRC, which focuses on trust and fraud, also has a mentorship program.

However, as mentioned, these trade associations are primarily focused on their members and are designed for continuing education. For example, to be eligible for the Electronic Transactions Association Certified Payments Professional (ETA CPP) program, candidates must possess either one year of industry-related experience and a high school diploma, associate, or bachelor's degree, or have three years of industry-related work experience. Continuing education and evaluation every three years are required to maintain the Certified Payments Professional credential in good standing. Regarding MRC, because only members know the organization's content, it is aimed at professionals who are already working in the field.

2.2 Corporate Education

The second venue for educating new payment professionals comes from the employers themselves. Recruiting college and graduate students for internships, young payment companies rely on that model to provide apprenticeship-like experiences. The following are three salient examples.

The first example is Stripe, a payment processing technology company. Its market value was over $95 billion dollars in 2022. As part of the onboarding process, Stripe aims to impart knowledge about infrastructure through work experience and engagement with colleagues (https://stripe.com/jobs/university). The second example is Visa University, where the focus is on corporate education at the network level. Its certification program focuses on dispute resolution (https://www.visauniversity.com/en/certificate-programs/visa-dispute-resolution-certification). The third example is the MasterCard Foundation's scholars' program, which is aligned with the network's strategic vision of expanding financial inclusion to the African continent. The program allows MasterCard to recruit students from leading higher education institutions in the US to "educate young people who are committed to the betterment of their communities" and "document and share best practices to identify, educate, and mentor students, and transition them into the workforce" (https://mcfscholarsprogram.berkeley.edu/partner-universities).

However, multiple challenges are involved in relying solely on trade associations or corporate programs. First, tying education to employers excludes much of the potential workforce because acceptance in such programs can be as competitive as acceptance into an elite university. Students may know about only a handful of companies in the fintech field, and they need to target them to gain access to internships and education. Second, each corporation educates its workforce in alignment with its corporate vision, which could limit students' access to information and opportunities. For example, Stripe, which operates using modern Application Programming Interface (API) technology, likely does not inform its engineers about legacy systems, which could make them less employable elsewhere. Third, some content produced by corporate training programs is skewed toward sales language and native advertising rather than empirical education. The reason is that these education programs are designed to promote the products of the respective company. Fourth, and most importantly, these programs focus on skill-based knowledge, leaving out cognitive (know-how/know what), affective and meta-cognitive knowledge (Anderson, 1982; Gupta, 2007). However, research evidence has shown that cognitive knowledge has a more significant impact on outcomes than skill-based knowledge (Sein et al., 1999).

Thus, overall, the existing education landscape lacks a broad-based, unbiased approach aimed at students before they enter the workforce. Based on this approach, students can be attractive to employers across the paytech industry. The only way to foster inclusion and diversity and attract top talent to the industry is through the promotion of paytech education at the university level. This requires a clear definition of the domain knowledge as part of this sector, which we will discuss in the next section.

3. DIGITAL PAYMENT DOMAIN KNOWLEDGE

The domain knowledge of paytech/digital payments needs further knowledge in this area. However, existing frameworks cannot be directly applied to this area. Industry frameworks, at best, represent areas in the fintech sector, or they focus only on innovations in this emerging area. Neither can be directly applied to the educational domain of digital payments. Thus, based on the Paytech/digital payment sector discussed above, the key question is the following: What is the domain knowledge of digital payment education?

To identify this domain, the authors of this study used an iterative three-pronged approach (see Figure 5). First, we reviewed relevant published academic and non-academic literature. Second, we conducted interviews with qualified individuals in the paytech industry. Third, we performed an analysis of current job postings. This approach had the advantage of methodological pluralism (Venkatesh et al., 2013), which helped us accurately identify the paytech/digital payments educational domain. This approach is summarized in the following section.

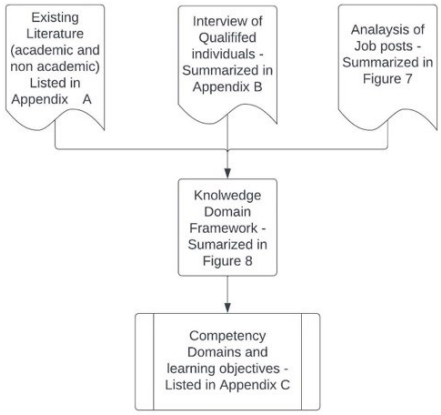


Figure 5. Research Process and Outcomes

We reviewed several published materials as well as the most recent literature on IS2020 and the CS2020 curricula for majors in information systems and computer science, respectively (Impagliazzo & Peers, 2018). The list of published materials reviewed is provided in Appendix A.

The findings of our literature review suggested that the domain of knowledge for digital payments comprises two major schools: computing schools and business schools. In computing schools, IS programs co-exist with other technical programs in other areas, such as computer science, information technology, software engineering, cybersecurity, and data science. This context provides excellent opportunities for sharing technical courses. In business schools, information systems programs co-exist with many business disciplines, such as accounting, finance, economics, marketing, management, organizational behavior, and supply chain management. This educational context provides excellent opportunities for sharing courses on the design, delivery, and use of technology in organizations. Hence, the profiles of these programs are often slightly use-domain oriented, and programs are referred to as "Business Information Systems," "Management Information Systems," or "Computer Information Systems" (Leidig & Salmela, 2021).

The second and equally vital component that emerged from our literature review was the need for transdisciplinary knowledge instead of interdisciplinary knowledge. Interdisciplinary courses rely on acquiring knowledge from multiple disciplines. Although this includes transdisciplinary courses, discipline boundaries, distinctions between pure and applied, and differences between institutions (e.g., between university and industry) are less relevant for transdisciplinary courses (Gibbons et al., 1994), which are focused on solution development. For example, the employee draws on a small piece of knowledge from each of the domains (e.g., business finance, how a transaction works, network transactions, software code, regulations, company needs, or customer needs) and creates new knowledge (e.g., new solutions) or solves the problem using existing knowledge (Crow & Dabars, 2021).

Third, each published work focused on a narrow and separate component of the digital payment sector. Thus, although the authors provided us with knowledge in this domain, the published works did not provide an overview of the domain knowledge. Thus, the need for empirical data collection emerged.

4. EMPIRICAL RESEARCH METHODS

As mentioned earlier, we used two empirical methods to answer the question regarding the domain of Fintech knowledge base: 1) interviews with industry experts; and 2) an analysis of existing job postings.

4.1 Method 1: Interviews With Industry Experts

We scheduled interview sessions with senior leaders (C-suite level, Human Resources (HR), and senior management) of companies who had experienced knowledge demand challenges. These interviews were based on prepared strategic questions and were facilitated by a faculty member who was a high-ranking member of the state university system and involved in fintech curriculum development. The data were collected across three industry groups, primarily in Georgia, to ensure that we captured the entire industry, including the following: multinational payment transaction companies with over 1,000 employees and multi-billion market caps; large fintech/payment companies with hundreds of employees and 100 million to 5 billion market caps; and small fintech companies/startups with under 100 employees. The data were collected in the spring of 2022.

The data gathered from these interviews were transcribed and collated by the interviewers. Appendix B presents a summary of the transcripts by outlining key themes that emerged. These intersecting themes emerged as key areas that comprised the domain knowledge in the digital payments area (see Figure 6). The four digital payment areas that emerged from this analysis were: technology and innovation; history and foundations of digital payments; risk, compliance, and regulations. We used these areas as starting points to develop a domain knowledge framework.

4.2 Method 2: Industry Job Analysis

One faculty member who was competent in web scraping and data analysis performed an industry job analysis during the summer of 2022. To gather data for the analysis, the query

"Digital Payment Jobs" was used to retrieve paytech-related job ads from Google.com, restricting the search to US-based jobs. Google automatically categorized the search results into distinct categories. We collected 131 job ads using "Digital Payment Jobs" and "Computer & IT" as the category in Google Search. We also collected job advertisements from LinkedIn. However, because of the substantial duplication of advertisements, we used the Google list because of its ability to sort duplications. For each of the job ads, we copied the text-on-the-job description as our major target for analysis. We used a noun phrase extraction algorithm called TextBlob Noun Phrase Extraction (Loria, 2020) to extract noun phases from all job descriptions. We then counted the frequencies of these phrases.

Figure 6. Transdisciplinary Nature of Digital Payment Competencies

4.3 Outcomes

Interestingly, when the following frequent phases were combined, a competency that could be called "digital product development" emerged. We aggregated similar phrases, such as "agile team," "agile environment," "agile products," and "agile," that shared a single keyword. The number beside each phrase or word indicated the percentage of job ads that contained that phrase or word.

As shown in Figure 7, the phrases covered separate phases and aspects of "digital product development," including business-oriented phases and aspects (e.g., competitive analysis, business requirements, and risk management) and IT-oriented phases and aspects (e.g., software/application development, technology solutions, agile, architecture, and infrastructure).

Figure 7. Process and Outcomes of Digital Payment Job Analysis

5. THE DOMAIN KNOWLEDGE FRAMEWORK

The main objective of this study was to discuss the domain knowledge needed by a graduate with digital payment expertise. This domain knowledge framework was necessary not only to represent the data and outcomes derived from the market-based methods outlined earlier, but also to adhere to principles of flexibility and commonality of language as well adaptability to tertiary education. We adopted the key ideas in the joint ACM/AIS IS2020 Task Force framework that pertained to the needs of both industry and academics (Leidig & Salmela, 2021).

Topi (2019) suggested that a competency-based approach is market-driven because it is based on the requirements of both students and employers in the industry. Specifically, Topi listed five advantages: 1) competencies represent what students need to learn, not what educators want to teach them; 2) competencies communicate expectations more clearly; 3) competencies encourage reflection by students; 4) competencies are more generalizable to a wider population; and 5) they fit well with accrediting agencies. Because the digital payment sector is based on market needs, we argue that this approach is suitable for this domain knowledge. Recently, a similar competency-based approach was used to design IS2020 and CS2020 curricula (Impagliazzo & Peers, 2018). Competency refers to the expected performance specifications associated with a profession. In other words, competency is a graduate's ability to apply knowledge, skills, and dispositions in each context (e.g., digital payments). Competency realms are groupings of competency areas, each of which represents a logical grouping of companies. These areas are usually used to build courses in academia. Combined, these competencies and realms form the domain of knowledge regarding a particular topic.

Figure 8 shows our domain knowledge framework for digital payments, which was based on a) the literature review, b) interviews with experts, and c) an analysis of job postings. The framework comprises five competency realms.

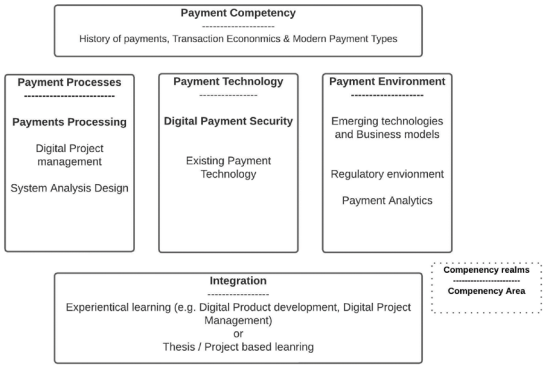


Figure 8. Domain Knowledge Framework of Digital Payments Education

The foundation is the essential realm and basic knowledge required by all individuals graduating in this area. Process, payment technologies, and environment represent realms with multiple areas of focus. Programs can focus on one or more of these areas depending on the resources available. The integrational realm is skill-based and allows students to apply their knowledge holistically. The market-based approach of this framework accounts for the integrated knowledge necessary for graduates to succeed in this area. The real domain and the learning objectives for each of the domains are summarized in Appendix C and are discussed in the following subsections.

5.1 Payment Competency Realm

Foundational competencies are introduced in an introductory course. These competencies improve as further courses are taken. This competency realm represents the overall digital payments/paytech domain. It also represents the foundational

knowledge that a graduate should have regarding the payment technology domain and the anatomy of a transaction, upon which the student builds knowledge acquired in further courses. This foundational layer is common in all variants of payment technology programs. Related topics include the history of payments, transactional economics foundations, and modern payment systems.

5.2 Process Competency Realm

The process realm consists of either the process through which payment technology functions or the process through which payment products are developed. It comprises three competency areas: payment processing, digital process management, and systems analysis and design.

Payment processing is focused on the payment process ecosystem, lifecycle, regulation, security, fraud protection, and payment networks. Students learn about payment products and services fraud, risk reduction strategies, the roles and responsibilities of issuers, acquirers, merchants, and banks, as well as strategies for maximizing payment usage while minimizing loss. Students also learn about payment negotiations, risk management, customer relationships, principles of authorization, settlement, chargeback, procedures, strategies, and best practices.

Digital project management focuses on concepts related to information technology (IT) project management (PM) regarding the development of digital payment products. Topics on critical thinking and the skills required to excel as a project manager are emphasized. Courses in this area tend to use case studies and project scenarios to familiarize students with real-life issues, constraints, and solutions while they use project management tools.

Systems analysis and design are focused on concepts underlying technical requirements and the application development techniques used to create a digital payment product process. Students acquire the ability to understand a scenario, its requirements, and the application of existing payment technologies to improve the payment process. The course exposes students to Unified Modeling Language (UML), business process management language, and other graphic modeling processes.

5.3 Payment Technology Competency Realm

A graduate of a digital payment program must understand existing payment technologies and the security ramifications of these technologies. Thus, two areas of focus in this realm are related to these issues: digital payment security and existing payment technology.

Digital payment security includes security, trust, and fraud issues in vertical payments. These areas are affected by the adoption of Artificial Intelligence (AI) and big data analysis (Bonsu et al., 2023). Students explore application security by addressing the challenges and weak points of applications, learn the tools and techniques of machine learning as a defensive security strategy to overcome the continuous automatic attack generated by machines, and engage in hands-on practice in penetration testing. Payment frameworks and standards, including the National Institute of Standards and Technology (NIST) cybersecurity framework, ISO 27001 information security management, and Payment Card Industry Data Security Standards (PCI DSS), are discussed. The administration of the information security function, including the strategic planning process, policies, procedures, and staffing functions necessary to organize and administer ongoing security functions, is also discussed. In addition, fraud, regulation, security practices, security architecture, continuous integration (CI), and operating environments are emphasized throughout the course.

The Existing Payment Technology knowledge realm includes a broad overview of each type of payment technology. Topics include, but are not limited to, Legacy vs. API-based card processing, debit and Automated Clearing House (ACH) transaction frameworks, peer-to-peer transactions in blockchain and stable coins, and real-time payments. The main objective is to understand the advantages and disadvantages of each area.

5.4 Payment Environmental Competency Realm

The digital payment industry is highly regulated. Despite the existing regulations, technological developments constantly expand boundaries, and businesses seek to exploit the digital nature of payments. This realm includes three areas: emerging technologies and business models, regulatory environment, and payment analytics.

The emerging technology realm is focused on existing critical payments infrastructure and assets to understand how current technologies work, their problems, and their future trends. Students also learn about the opportunities presented by emerging payment technologies. This course challenges students to develop ideas, write business cases, and develop mock solutions for a transition.

The regulatory environment area comprises the principles and practices in each type of existing payment, its regulations, and its inherent risks. Federal and state regulatory environments are discussed in relation to consumer protection, the Bank Secrecy Act, anti-money laundering, and general supervisory environments, including the knowledge of customers.

Payment analytics provides a foundation for the financial data analytics used in business and digital payments. The objective of this course is for students to gain experience in analyzing financial data using modern machine learning techniques, statistical methods, and prediction models. Students develop the computational skills to perform data analyses using a modern statistical programming environment. They apply these skills to address a range of problems and opportunities encountered because of the digital nature of payments.

5.5 Integration Competency Realm

This layer deals with the application of knowledge in the payment technology area. Students use an apprenticeship model, thesis-based model, or project-based model. In one example of an apprenticeship-based approach, students engage in team-based interactive virtual experiential learning with a collaborating industry partner to gain on-the-job experience. Stakeholders in the industry partner interact with students both synchronously and asynchronously. A virtual collaboration platform is used to enroll, onboard, empathize, reboot, experiment, and deliver business solutions for client problems. Students are mentored, trained, and given practice on the tools and techniques used in the industry. Students' progress is tracked using a feedback loop to improve their learning. Prototyping and experimentation are encouraged to understand "real-world" issues. Partner companies share their anonymized datasets, tools, and techniques. Coaching activities, including

design thinking, backlog management, and business modeling, are used in this course.

6. CONCLUSIONS

This article discusses the growth of fintech in the US and its growth in six sectors, each of which has distinct needs and focuses. The largest of these sectors is digital payments/paytech, which concerns the use of technology in modern payment systems. Such systems include traditional systems that are automated as well as new systems that are developed based on new technology affordances (Du et al., 2019; Mention, 2019). Over the last decade, there has been steady growth in digital payment systems, which increased significantly in 2020 during the COVID-19 pandemic across all sectors and age groups.

Based on this growth, there is a significant need for individuals who are trained in the fintech area. However, because of the transdisciplinary nature of knowledge in this sector, statistical information and evidence are limited. Based on the literature review (Appendix A) and the dual research methodology (i.e., industry expert interviews and analysis of job postings), this article demonstrates the domain of knowledge needed by an individual graduating in this area. The domain embodies the principles of a competency-based approach that is flexible. The domain is broadly divided into three areas: 1) foundation knowledge needed by everybody; 2) competency realms, such as payment process, payment technology, and payment environment; and 3) integration, by which students can combine and apply their knowledge. Each area is described and discussed in detail.

The next step in the process is to develop individual courses and competencies for each realm to clarify the domain and outline the knowledge framework in this area. This endeavor would benefit universities as follows: a) developing and designing courses, b) choosing a focus within the overall framework, and c) evaluating the programs. One approach would be to develop competencies specified in job postings (Figure 7) and map them to individual courses and areas, as shown in Figure 8, which would ensure a complete knowledge framework. Another approach would be to determine which components of existing courses could be mapped to this domain of knowledge, thereby providing universities with the ability to use their existing expertise.

7. REFERENCES

Allied Market Research. (2021). Fintech Technologies Market Outlook – 2030. https://www.alliedmarketresearch.com/fintech-technologies-market

Anderson, J. R. (1982). Acquisition of Cognitive Skills. *Psychological Review*, 89(4), 369-406. https://doi.org/10.1037//0033-295X.89.4.369

Anifa, M., Ramakrishnan, S., Joghee, S., Kabiraj, S., & Bishnoi, M. M. (2022). Fintech Innovations in the Financial Service Industry. *Journal of Risk and Financial Management*, 15(7), 287. http://dx.doi.org/10.3390/jrfm15070287

Art, R., & Senn, J. (2017). *Fintech Talent Development Playbook*. University of Georgia.

BLS. (2018). Standard Occupational Classification System. https://www.bls.gov/soc/2018/major_groups.htm

Bonsu, M. O.-A., Wang, Y., & Guo, Y. (2023). Does Fintech Lead to Better Accounting Practices? Empirical Evidence. Accounting Research Journal, 2/3(36), 129-147. https://doi.org/10.1108/arj-07-2022-0178

Capgemini. (2020). *World Payments Report*. https://worldpaymentsreport.com/

Chishti, S., Craddock, T., Courtneidge, R., & Zachariadis, M. (2020). *The PAYTECH Book: The Payment Technology Handbook for Investors, Entrepreneurs, and FinTech Visionaries*. Wiley Online Library. https://doi.org/10.1002/9781119551973

Crow, M., & Dabars, W. (2021). *The Fifth Wave: The Evolution of American Higher Education*. Johns Hopkins University Press.

Das, S. R. (2019). The Future of Fintech. *Financial Management,* 48(4), 981-1007. doi:10.1111/fima.12297

Du, W. D., Pan, S. L., Leidner, D. E., & Ying, W. (2019). Affordances, Experimentation and Actualization of Fintech: A Blockchain Implementation Study. *The Journal of Strategic Information Systems,* 28(1), 50-65. https://doi.org/10.1016/j.jsis.2018.10.002

E&Y. (2019). Global Fintech Adoption Index. https://www.ey.com/en_gl/ey-global-fintech-adoption-index

Federal Reserve. (2019). *The 2019 Federal Reserve payments study*. https://www.federalreserve.gov/paymentsystems/2019-December-The-Federal-Reserve-Payments-Study.htm

GreenSheet. (2014). Reevaluating the ETA CPP. *The Green Sheet Online Edition*, 14:09:01. http://www.greensheet.com/emagazine.php?emagazineIssueNumber=140901

Gibbons, M., Limoges, C., Nowotny, H., Schwartzman, S., Scott, P., & Trow, M. (1994). *The New Production of Knowledge: The Dynamics of Science and Research in Contemporary Societies*. Sage Publications, Inc.

Gobble, M. M. (2018). Digitalization, Digitization, and Innovation. *Research-Technology Management*, 61(4), 56-59. https://doi.org/10.1080/08956308.2018.1471280

Gupta, S. (2007). Simulations and Technology Training: A Need to Revisit Training Goals. *Business Education Forum*, 62(3), 51-54.

Impagliazzo, J., & Pears, A. N. (2018). The CC2020 Project—Computing Curricula Guidelines for the 2020s. *Proceedings of the 2018 IEEE Global Engineering Education Conference (EDUCON)* (pp. 2021-2024). Santa Cruz de Tenerife, Spain. https://doi.org/10.1109/EDUCON.2018.8363484

KPMG. (2020). Pulse of Fintech H1'20. https://home.kpmg/au/en/home/insights/2020/09/pulse-of-fintech-h1-2020.html

Leidig, P., & Salmela, H. (2021). *IS2020: A Competency Model for Undergraduate Programs in Information Systems.* https://www.acm.org/binaries/content/assets/education/curricula-recommendations/is2020.pdf. https://doi.org/10.17705/1CAIS.05021

Loria, S. (2020). TextBlob: Simplified Text Processing. https://textblob.readthedocs.io/en/dev/

Mention, A. L. (2019). The Future of Fintech. *Research-Technology Management*, 62(4), 59-63. https://doi.org/10.1080/08956308.2019.1613123

Rabbani, M. R., Bashar, A., Nawaz, N., Karim, S., Ali, M. A. M., Rahiman, H. U., & Alam, M. S. (2021). Exploring the Role of Islamic Fintech in Combating the Aftershocks of COVID-19: The Open Social Innovation of the Islamic Financial System. *Journal of Open Innovation: Technology, Market, and Complexity*, 7(2), 136. https://doi.org/10.3390/joitmc7020136

TAG Online. (2020). Geogia FinTech Ecosystem Brief. https://www.tagonline.org/wp-content/uploads/2020/10/2020-Fintech-Ecosystem-Brief.pdf

Topi, H. (2019). Invited Paper: Reflections on the Current State and Future of Information Systems Education. *Journal of Information Systems Education,* 30(1), 1-9.

Venkatesh, V., Brown, S. A., & Bala, H. (2013). Bridging the Qualitative-Quantitative Divide: Guidelines for Conducting Mixed Methods Research in Information Systems. *MIS Quarterly*, 37(1), 21-54. https://doi.org/10.25300/MISQ/2013/37.1.02

WEF. (2015). The Future of Financial Services. http://www3.weforum.org/docs/WEF_The_future__of_financial_services.pdf

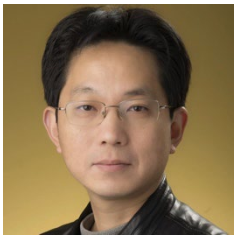
Zhang, Y., Xing, C., & Guo, X. (2023). The Shielding Effect of Access to Finance on Small and Medium-sized Enterprises During the COVID-19 Crisis: Comparing Fintech and Traditional Finance. *Emerging Markets Finance and Trade*, 59(8), 2383-2397. https://doi.org/10.1080/1540496X.2022.2072201

Zwass, V. (2018). Editorial Introduction. *Journal of Management Information Systems*, 35(1), 1-11. https://doi.org/10.1080/07421222.2018.1440754

AUTHOR BIOGRAPHIES

Saurabh Gupta is a professor of information systems and the Executive Director of the Ph.D. in Business Administration program at Kennesaw State University. He completed his Doctorate in MIS at the Terry College of Business, University of Georgia. His work experience is in the field of knowledge management, system design and enterprise resource planning implementation. His research publications have been published in leading MIS journals such as *Journal of MIS*, *Information Systems Research*, *Journal of the Association for Information Systems*, and *Information Systems Journal.* His research interests are in technology training, theory building and the use of complex technologies.

Ying Xie is a professor in the College of Computing and Software Engineering at Kennesaw State University. His present research interests are primarily in data science and AI. Dr. Xie currently serves as the Director of the Home Depot Data Science Lab @KSU. His research has been sponsored by multiple US companies and the National Science Foundation (NSF). Dr. Xie holds two US patents in data analytics and several pending US patents. He was involved in organizing multiple international conferences and workshops on different fields of computing and information technology.



Humayun Zafar is a professor of information security and the Fintech Program Director at Kennesaw State University. He also serves as an Assistant Chair in the Department of Information Systems and Security. He earned a Ph.D. in Business Administration with an emphasis in IT from the University of Texas at San Antonio. His research interests include cybersecurity and fintech. His work has been published in conferences and journals such as *HICSS*, *Communications of the AIS*, and *Information Systems Frontiers*.

APPENDICES

Appendix A. Published Works Reviewed For This Article

- Chishti, S., Craddock, T., Courtneidge, R., & Zachariadis, M. (2020). *The PAYTECH Book: The Payment Technology Handbook for Investors, Entrepreneurs, and FinTech Visionaries*. Wiley Online Library.
- Goldfinch, P. (2019). A global guide to fintech and future payment trends.
- IGI Global & Information Resources Management Association. (2018). *Digital currency: Breakthroughs in research and practice*. IGI Global
- Kou, W. (2002). *Payment technologies for e-commerce*. Springer.
- Lewis, A. (2018). *The basics of bitcoins and blockchains: An introduction to cryptocurrencies and the technology that powers them.* Mango
- Mehta, N., Agashe, A., & Detroja, P. (2020). *Bubble or revolution: The present and future of blockchain and cryptocurrencies*. Paravane Ventures
- Morse, E. A. (2018). *Electronic payment systems: Law and emerging technologie*s. American Bar Association.
- Rambure, D., & Nacamuli, A. (2008). *Payment systems: From the salt mines to the boardroom*. Palgrave Macmillan.
- Sein, M. K., Bostrom, R. P., & Olfman, L. (1999). Rethinking end-user training strategy: Applying a hierarchical knowledge-level model. *Journal of End User Computing, 11*(1), 32-39.
- Sherif, M. H. (2004). *Protocols for secure electronic commerce*. CRC Press.
- Swartz, L. (2020). *New money: How payment became social media*. Tantor and Blackstone Publishing.
- Téllez, J., & Zeadally, S. (2017). *Mobile payment systems: Secure network architectures and protocols*. Springer International Publishing.
- Turrin, R. (2019). *Innovation lab excellence: Digital transformation from within*. Authority Publishing
- Wewege, L., & Thomsett, M. C. (2020). *The digital banking revolution: How fintech companies are transforming the retail banking industry through disruptive financial innovation*. De Gruyter

Appendix B. Data Analysis in Study 1 – Industry Expert Interviews

Qualitative stems that emerged	**DETAILS TO GUIDE THE EFFORT/Excerpts from interviews**
Foundation of digital payments	Foundations of payments. Ensure that people know the basics and fundamentals of a payment, a transaction, and the movement of money. No one knows the basics of a network or what happens when a purchase is made. People need to understand all the roles within the ecosystem. In addition to understanding the ecosystem, it is important to understand its layers, roles, functions, and processes. Economics of payments Four areas: Acquirer (processors and banks) vs. issuer (processors and banks), or … three areas? Issuing (bank), merchant (target), processor (FIS). It is important to know the four-party model. They should learn the players and how they interact (b2b, b2b, c2c) and know the types, roles, and relationships. Digital financial technology (i.e., digital payments), including ecommerce, online, app-driven, and different purchasing models. Differentiate between technical and non-technical (business and revenue streams). US vs. international comparisons
History of digital payments	The origin of payments, why things work the way they do, how the US system evolved and emerged, ensure people understand what is/is not moveable/changeable. They need to know the boundaries and how to solve challenges within them; know the legacy of the ecosystem. Learn how it is done in other places (e.g., Asia and Africa) and compare it to US history.
Risk, compliance, and fraud	Risk in payments Compliance in payments. People need to know its importance, that people are highly specialized in this area, and that they should know when to call on them. Tracking identity (KYC, AML)
Regulations	Regs. E and Z and CFPB (at an introductory level; enough to know they exist and how they impact the ecosystem and processes) Understanding at a high level how regulations are associated with or inform each role or process A recommendation for learning how and why payments work the way they do. For example, Regulation "E" of the federal guidelines (ACH, credit, and debit) defines how payments must work according to rules and regulations. The content itself is not exciting, but it clarifies how payments must work and helps people understand why payments exist and operate in the US. If this regulation were approachable, it would facilitate an understanding of payments and how they could be improved within this framework.
Technology and innovation	Innovation – disruptive, new, AI, machine learning, BI, IoT, robotics; find people with an innovative sense who are curious, learn how to engage in innovation, people with acute awareness who want to know how/when/why, develop change management awareness and skills. Disruptive technologies in the industry (current and potential) Protocols Gamification API movement: data move first to reflect payment and receipt, and money movement follows later (batch at the end of the day); ways to do both instantaneously are under development.

	Digital financial technology (i.e., digital payments), including ecommerce, online, and app-driven purchasing models. Know the technologies that make the industry possible, as well as current and future innovations.
Problems in payments/digital payments (limitations, access, bias, and diversity)	Unbanked people cannot participate in the digital economy: limitations of the current system; limitations of current technology; problems with bias in the digital payments system and technology.

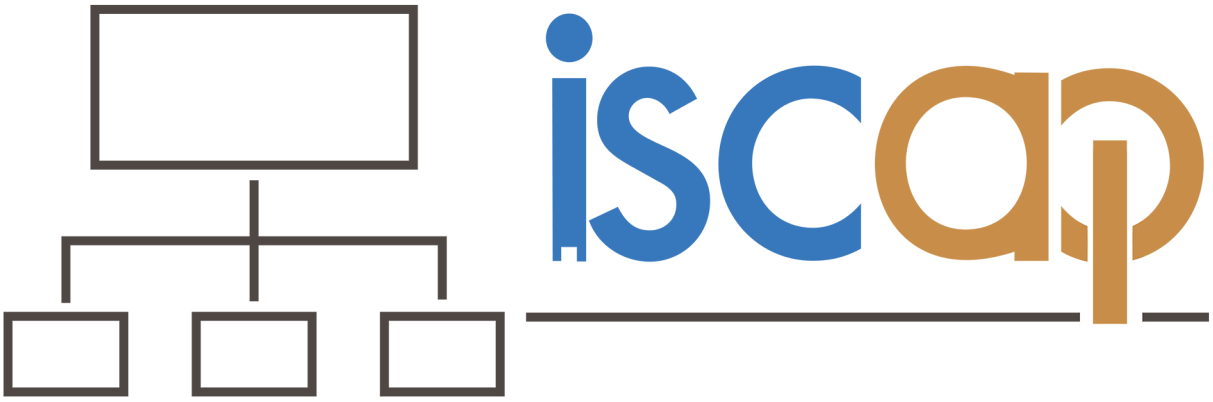
Appendix C. Competency Domains and Learning Objectives

Competency = [Knowledge (know-what) + Skills (know-how) + Dispositions (know-why)] in Tasks		
Competency Realm	**Competency Area**	**Competency**
		Competency Statement
Foundations - Represents the foundational knowledge that a graduate should have regarding the payment technology domain and the anatomy of a transaction	**Foundations**	LO1: Understand recent fintech developments and analyze their impact on the financial services industries.
		LO2: Describe the technologies underlying cryptocurrencies and blockchains.
		LO3: Understand the impact of fintech on traditional banking and developments in payments, digital banking, alternative lending, and P2P technologies.
		LO4: Understand crowdfunding and its impact on investment banking and entrepreneurial financing.
		LO5: Understand InsurTech and innovations in the insurance industry
		LO6: Engage in the process of fintech innovation.
Payment Processes Processes realm deals with either the process through which payment technology's function or the process through which payment products are developed.	**Payment Processing**	LO1: Differentiate between open and closed loop payment systems.
		LO2: Describe the processes and lifecycle of the payment industry sector.
		LO3: Explore payment products and services.
		LO4: Know the applicable regulations, standards, and security.
		LO5: Define global payment methods.
		LO6: Recognize next generation payment methods.
	Digital Project Management	LO1: Assess the application of traditional and agile project management approaches.
		LO2: Evaluate project risk management.
		LO3: Discuss project management portfolios and programs.
		LO4: Describe how to achieve success with global and virtual project teams.
		LO5: Apply the use of a project management toolset like MS Project.
		LO6: Explore how to select a project management methodology from the adaptive (agile) and predictive continuum.
	System Analysis and Design	LO1: Understand the systems analysis and design (SAD) framework and methodology.
		LO2: Learn how to prepare UML-based models using techniques based on object-oriented design principles to reinforce the processes of requirements gathering and documentation.
		LO3: Identify and interpret UML models.
		LO4: Design systems using object-oriented techniques to deliver quality system and program specifications.
		LO5: Understand the implementation, testing, and deployment of SAD initiative.
Payment Technology Understand existing payment technologies and the security ramifications of these technologies.	**Digital Payment Security**	LO1: Understand security mechanisms that protect digital payment data.
		LO2: Understand methods of encryption of transmission of digital payment data.
		LO3: Define steps taken to protect payment processing data.
		LO4: Create policies that address information security.
		LO5: Understand PCI DSS.

		LO6: Create a self-assessment questionnaire (SAQ).
		LO7: Discuss digital payments security frameworks.
	Existing Payment Technology	LO1: Differentiate between open and closed loop payment systems.
		LO2: Describe the processes and lifecycle of the payment industry sector.
		LO3: Explore payment product and services.
		LO4: Know the applicable regulations, standards, and security.
		LO5: Define global payment methods.
		LO6: Recognize next generation payment methods.
Payment Environment Understand regulations while exploiting the digital nature of payments.	**Emerging Technologies and Business Models**	LO1: Describe the payments technology stack dominant in US financial systems.
		LO2: Demonstrate how payments flow in most US financial systems.
		LO3: Describe payments technology stack unencumbered by technical debt.
		LO4: Demonstrate a frictionless payments flow.
		LO5: Ideate technology solutions for digital payments transitioning.
		LO6: Develop mockups for the transition.
	Regulatory environment	LO1: Investigate government(s) role(s) in oversight and regulation of payments (US).
		LO2: Evaluate the legislation relating to digital payments (Dodd-Frank, Sarbanes- Oxley, Reg S, Reg X, Reg E, Reg Z).
		LO3: Interpret the agency regulation of digital payments (CFPB, USDoC, and USDoT) impacts of digital payments on government operations and international relations.
		LO4: Understand the industry defined standards that impact payments/digital payments (global).
		LO5: Critique government regulations in international markets such as UK, EU (developed markets), Latin America, India, Australia, and China.
	Payment Analytics	LO1: Comprehend and follow the recommended process model (CRISP-DM) for data mining.
		LO2: Demonstrate a comprehensive understanding of the interrelationship among different phases of the recommended process model.
		LO3: Recognize the importance of business understanding in data mining projects and its impact on subsequent phases.
		LO4: Recognize the importance of data understanding in data mining projects and its relationship with other phases.
		LO5: Employ data visualization techniques to drive further insights from data and enhance business and data understandings
		LO6: Employ data wrangling techniques to manipulate (clean and transform) data to prepare it for the modeling phase.
		LO7: Conduct appropriate analysis according to business goals and data specifications.
		domain oriented)
		LO8: Evaluate the results of the analysis.
		LO9: Formulate actionable business solutions.
		LO10: Learn new analytics software applications and data mining techniques independently
Integration Students engage in a team-based	**Experiential Learning**	LO1: Empathize with client problem statement, describe the expected user's experience.
		LO2: Explain backlog management in agile/scrum perspective.

interactive virtual experiential learning with a collaborating industry partner to gain on-the-job experience.		LO3: Restate client problem statement in industry perspective.
		LO4: Demonstrate task board creation and management.
		LO5: Describe user/sponsor experience.
		LO6: Present project deliverables.
		LO7: Practice experimentation and continuous reinvention.

INFORMATION SYSTEMS & COMPUTING ACADEMIC PROFESSIONALS



STATEMENT OF PEER REVIEW INTEGRITY

All papers published in the ***Journal of Information Systems Education*** have undergone rigorous peer review. This includes an initial editor screening and double-blind refereeing by three or more expert referees.

ISSN: 2574-3872 (Online) 1055-3096 (Print)