Issues in Information Systems
Volume 24, Issue 2, pp. 84-92, 2023

DOI: https://doi.org/10.48009/2_iis_2023_108

Careers and skills in the enterprise blockchain industry for information systems graduates

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Abstract

The objective of this study was to gather current skill requirements in the blockchain industry so information systems graduates could use the findings for possible employment in the industry. I collected 30 blockchain job announcements from two popular job sites, *LinkedIn*, and *Indeed.com*, and then synthesized and organized the findings into two alternate paths that IS graduates may take to pursue careers in this industry: the *business and management* path requires minimal preparation for the IS graduates, while the technical path is more involved but feasible for them as well. The findings of this study are expected to be of practical help for the IS graduates as well as IS curricula committees in designing and offering courses in blockchain.

Keywords: blockchain, Ethereum, smart contracts, decentralized applications (dApps)

Introduction

A blockchain is a database or ledger shared among group of entities and distributed among the nodes of a peer-to-peer network (Hayes, 2023). The entities in the shared network may be organizations, applications, or individual users; and the ledger contains digital records of business transactions. One of the essential properties of this technology is that the data in a blockchain database is considered immutable, i.e., once a record is inserted in the database, it cannot be altered. Cryptography and other mechanisms are used to ensure that the history of previous transactions is maintained without any manipulations (Hertig, 2021).

Enterprise blockchains are different from *public* blockchains. One fundamental difference between enterprise and public blockchains is that most enterprise blockchains are *permissioned* whereas public blockchains are not. Well-known public blockchain networks are such as those used by various cryptocurrency platforms. In permissioned blockchains, organizations have full control over the blockchain network membership and they enforce specific policies in order to meet any regulatory requirements and comply with the laws.

In permissioned blockchains, users are authenticated to access the platform, and can access data and perform operations based on their roles assigned to them by the ledger administrators. (Oracle Corporation, n.d.). In a 2019 survey of global companies conducted by Deloitte (Deloitte, 2019) 53% of the respondents believed that blockchain technology had become a critical priority for their companies. In 2021, among the popular US organizations exploring the use of enterprise blockchain included Facebook, Mastercard, IBM, Intel, and Walmart (Hertig, 2021).

Blockchain skills and use cases

The objective of this study is to examine and document technical skills in the blockchain industry. The findings of the study are expected to be of practical use for information systems (IS) graduates as well as in IS curriculum development. Information systems (and/or management information systems –MIS) is a discipline or major in most Schools and Colleges of Business in the US. Besides other required and elective courses, students typically take at least one course each in a programming language, database management, computer networking, and systems analysis and design. These and other courses students take as part of their bachelor's degree requirements, provide them with necessary knowledge and foundational skills to acquire skills in the blockchain industry. Identifying closely matching skills in related but different industries is based on the concept of *skill adjacency*, which has been recognized as a practical strategy to fill the increasing skill gap due to rapidly changing technology in the workplace and the need for recent graduates and current employees to train or retrain (Baker & Zuech, 2021; Dapena, 2019; Shirani, 2022). Having prerequisite skills makes it easier for an individual to train for the next adjacent or higher level skill. A recent study by LinkedIn (LinkedIn, 2020) prepared for the World Economic Forum indicates that about half of the employees who were hired in data science and artificial intelligence jobs came from other unrelated industries after retraining and benefiting from this strategy.

Selected use cases

Decentralized finance: With decentralized finance (DeFi) applications, typical banking services can be provided to anyone without the need for a bank as an intermediary. For example, one may use the Ethereum currency, ether, as a collateral to take out loans, provide liquidity to earn interest on funds, or exchange funds (Ethereum, 2023).

Supply chains: Food industry is increasingly using the blockachain technology to track the path of agricultural products from the farm to the end users (Radocchia, 2018). Likewise, suppliers are using blockchains to record the sources of their materials in order to verify and validate authenticity of the products labeled as organic or fair trade.

Healthcare: Healthcare providers can use blockchains for storing patients' records ensuring immutability and access to health records by authorized users only through the use of a private key (Hayes, 2023).

Property records: Establishing and maintaining the integrity of property records is an essential service that authorities in some parts of the world have difficulty providing. Blockchain technology can be of help in recording property ownership and verification, which in turn ensures the owners about accuracy of their deeds and permanency of the ownership records (Hayes, 2023).

Other use cases: Blockchain technology is also used for a variety of other use cases such as blind auctions, voting, crowdfunding, and multi-signature wallets.

Methodology

Data collection

The data for the study were collected by me from two popular websites for professional job postings: *Indeed.com*, and *LinkedIn*. Indeed.com is a somewhat more popular platform for both employers and job seekers. Compared to other major job boards, Indeed.com offers a streamlined hiring process, easy job

posting, and on-platform interviews. It is also more accurate and useful than other major similar platforms, both for job seekers and employers (Miranda & Bottorff, 2023). LinkedIn offers a professional networking, learning, and job search.

Following the criteria and the process used in other similar studies (e.g., Shirani, 2022), job descriptions for 30 job postings were copied and pasted into a text document for further analysis. For the job search process, I used the terms *blockchain, blockchain smart contracts, Ethereum,* and *blockchain developer*. These terms were chosen due to their high frequency in the job postings. The geographic location was set to the entire USA. Of the many listings generated by the search terms, only those postings were retrieved that met the following criteria:

Academic qualifications: Since the focus of this study is on blockchain skills for information systems graduates, it was necessary to ensure that their academic qualifications were acceptable for the listed position. Announcements that restricted the position for specific disciplines such as Computer Science or Computer Engineering were not retrieved for inclusion in the study.

Mode of work: In recent years, certain positions have been offered for online or remote work only, and others for on-premises or in-person work. For this study, positions for either or both modes of work were included. One job announcement from each of the companies listed in Table 1 was included in the data sample.

Table 1: Sources of Data

Braintrust	Espresso	Injective Labs	Phaxis	TalentWeb3
Cash App	Ex Populus	Metaverse Academy	Protochain Research	Technical Paradigm
CertiK	Finnt	NEAR	Protochain Research	Unfinished Labs
Coinbase	Ghritachi Inc	NJC Labs	Rubicon	UPS
CryptoRecruit	Ignite	Offchain Labs	Seashell	Validation Cloud
DApp360 Workforce	Infomind Solutions	Parcl	Stability	x137Labs

Data pre-processing

Two categories of skills are typically part of a professional job requirements: "soft" skills, and "hard" or technical skills. "Soft skills are personality traits and behaviors that will help candidates get hired and succeed in their work. Unlike technical skills, soft skills are interpersonal and behavioral skills" (Indeed.com, 2022).

Examples of soft skills include creative thinking, problem solving, written and oral communication, teamwork, and others. Traits such as personality, attitude, flexibility, motivation, and manners help a person to fit-in at their workplace (Doyle, 2021). Soft skills are considered complimentary to technical skills required for a job, and either set of skills alone is not sufficient for most jobs.

In the data collection phase, descriptive details of all of the job postings including both soft and technical skill requirements were copied from the two job websites and pasted into a text document. However, since the focus of this study is on technical skills only, a second text document was created which included only the technical skills. This second document was then used for further processing.

Results

Data processing was done using text mining as well as manually by me. Text mining was primarily used for generating a word or term count from the text document containing job descriptions, and then generating a word cloud for visual observation. Figure 1 shows relative count of 15 most frequent terms that appeared in the document. The font size of the term is directly proportional to the count of the term. As can be seen in this figure, some of the terms that are frequently required include the Ethereum network, smart contracts, blockchain, and several programming languages for writing smart contracts – with Solidity, Rust, Golang, and JavaScript being some of the more popular languages.

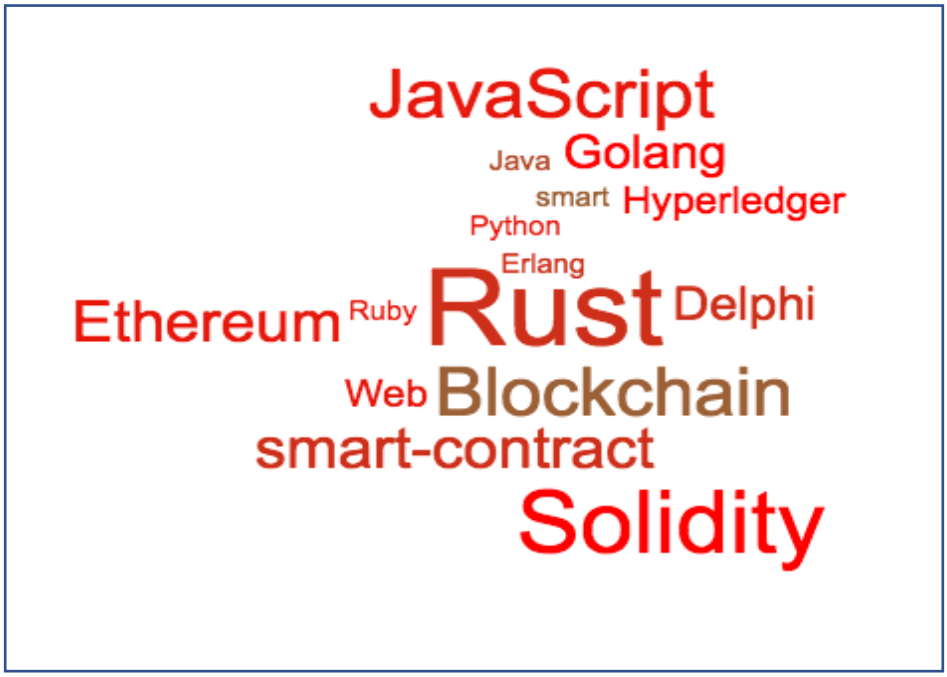

Figure 1: Visual Data Exploration with a Word Cloud

Ethereum: Ethereum is a decentralized computing network built on the blockchain technology (Rodeck, 2023). There are a large number of apps such as games, financial apps, and many more that are currently running on the Ethereum blockchain.

Smart contract: A smart contract is a computer program that automates the actions necessary to enforce an agreed upon contract. Once the program successfully executes, the underlying transactions are trackable and irreversible (Frankenfield, 2023).

Solidity, Rust, and other languages: Although Solidity is considered the primary language on the Ethereum network, a number of other programming languages can also be used as shown in Figure 1.

After a thorough analysis of the blockchain industry skill requirements and literature review, I then synthesized and organized skills and job roles for a meaningful and practical use of the study findings. Comprehensive findings of the study are presented in Figure 2. Two distinct career paths are suggested and IS graduates may like to pursue one or the other, or both.

Learning the foundational blockchain knowledge and skills are the starting point for both paths. The foundational layer introduces essentials concepts with hands-on work using popular blockchain software and platforms (Microsoft, 2023). To learn the foundational skills, there are several online learning opportunities available such as those offered by LinkedIn, Udacity, Microsoft, and others.

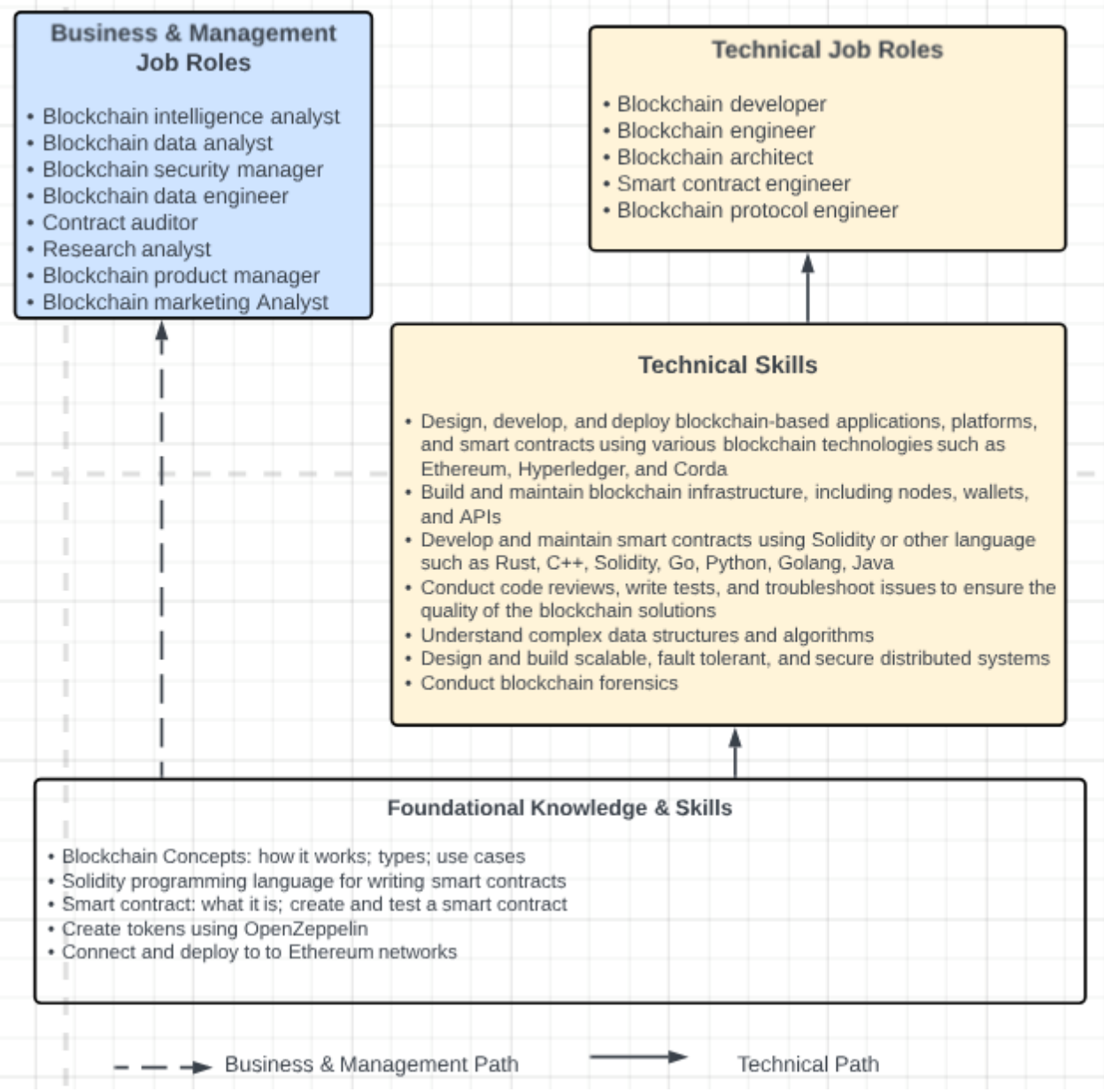

Figure 2: Two Paths to Blockchain Careers for IS Graduates

The *Business and Management path* (shown left in Figure 2) is almost the direct path for IS graduate to enter into blockchain careers. Like all other industries, the blockchain industry also needs data engineers, data analysts, data scientists, security professionals, auditors, marketing analysts, and more. Information systems graduates have adequate subject-area preparation for many of the job roles listed in this path.

Also, this list is not exhaustive but is indictive of business and management job roles available in the blockchain industry.

Discussion

The *Technical path* (shown right in Figure 2), requires substantial additional preparation if an IS graduate prefers to follow this path. Again, training is readily available from several online learning platforms for those IS graduates who may be motivated to pursue this path. Based on the skill adjacency concept (e.g., Dapena, 2019; Shirani, 2022), the typical IS curriculum offers adequate preparation for the graduates to pursue careers in closely related new fields such as the blockchain after further training.

Mapping IS curriculum to blockchain job roles

A typical bachelor's IS curriculum in the US business schools that follows the ACM/AIS model confers graduates with necessary foundational knowledge and skills for them to undertake further training in the blockchain industry.

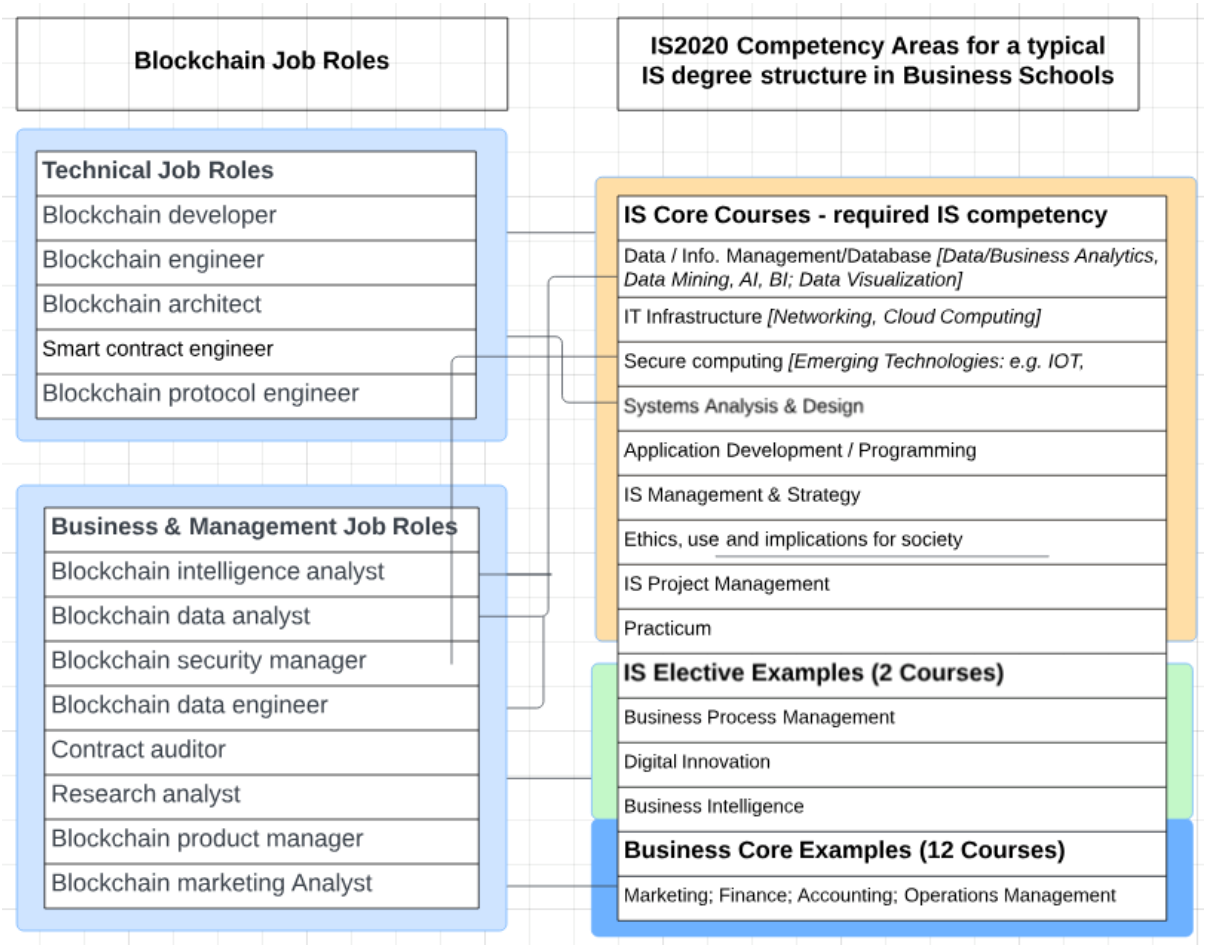

Figure 3: Mapping IS Curriculum to Blockchain Job Roles

Figure 3 maps the IS model curriculum to common blockchain job roles. The job roles listed in the left-side panel of the diagram were identified by me through the job announcements survey, and the curriculum details in the right-hand side panel are from the ACM/AIS model curriculum (Leidig & Salmela, 2020). The lines connecting competencies with job roles within Figure 3 show a few selected examples to illustrate the sufficiency of selected IS competencies as foundational knowledge for a blockchain role.

For blockchain job readiness, however, further specific training would be required. In general, the IS core curriculum comprising of six courses clearly maps well to the blockchain technical job roles, and the core business curriculum comprising of 12 courses maps to blockchain business and management job roles. Altogether, the two sets of core course and two electives provide a sound foundation for IS graduates to train for either or both of the two blockchain job tracks.

Post-graduation training

In order for IS graduates to be ready for technical and non-technical blockchain jobs, necessary training would be required. Such training, for example, can be in the form of a blockchain certificate program. Alternatively, blockchain training can be offered as part of the bachelor's degree program, either as a business major or an IS minor. Depending on which of these alternatives is selected and also which of the two paths (technical or non-technical) is chosen, the current industry practices suggest that approximately 3-5 blockchain courses may be necessary. Given below is a sample list of courses that I selected from a few popular training outlets. This list is not exhaustive but only indicative of the diversity of courses that can be offered to suit the needs of both technical and non-technical blockchain job roles.

Introduction to blockchains (Microsoft Corporation, 2023): Introduces foundations of blockchain and how blockchain technology works; gain an understanding of the tools to develop on the Ethereum blockchain; create smart contracts and decentralized applications; deploy to local and test Ethereum networks.

Blockchain development with Solidity (Udemy, 2023): Introduces Solidity programming; how decentralized technology works; blockchain and smart contracts theory and practice; the development functions of Ethereum; using Ethereum's core development tools.

Application development for the Ethereum platform (Udemy, 2023): Why to create an app with Ethereum; build blockchain applications using the Ethereum blockchain; design, test, and deploy secure smart contracts; use the latest Ethereum development tools.

Blockchain in global supply chains (Coursera, 2023): Blockchain in global trade; reducing supply chain complexity; IoT and sensor-based logistics; provenance and traceability

Blockchain security (Coursera, 2023): Fundamentals of blockchain security; consensus algorithm security; smart contract security.

Conclusion

This study presented the recent set of technical skills required for jobs in the blockchain industry. Based on the skill adjacency concept, IS graduates typically have the necessary preparation to quickly transition to jobs in the blockchain industry. After a review and analysis of the data from 30 different position announcements, two separate paths are recommended for the IS graduates. The *business and management*

path is essentially a direct path for the IS graduates since it requires minimal additional learning. A more technical path, however, does require additional training but may be appealing to certain graduates as well.

One limitation of this study is that the selection of the two job sites and the 30 job announcements were done by me, which may introduce a selection bias. These selections, however, were curated based on specific criteria described in the methodology section of the paper.

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