BLOCKCHAIN EXPERTISE PROJECT

SOFTWARE ENGINEERING AND CRYPTO FINANCE

KING'S College LONDON

Future of Financial Work Research Centre

Expertise in the Crypto and Blockchain Industries: What Are the Challenges?

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The development and deployment of blockchain technologies require different types of expertise to collaborate on a sustained, continuous basis. Collaborations are not easy. How do they look like in practice in crypto and blockchain firms? What are their challenges and how do collaborators see each other? Where is the expertise located? To find out, we conducted over 170 interviews worldwide with professionals in the crypto and blockchain industry. We also analysed one year of LinkedIn job adverts, together with Crunchbase data. Here are the results…

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Summary

- In 2021, there were over 14,000 LinkedIn job adverts in the crypto and blockchain industry. The UK provides almost a quarter of all job adverts, although it has less than 7% of all blockchain and crypto firms worldwide (Figures 2 and 3).
- The demand for specific profiles appears to be different across countries and regions. Manager, trader, analyst, and engineer are the most frequent UK-based positions appearing in job adverts.
- Patterns in job advert profiles are similar for Hong Kong and China and somewhat similar for the UK and the US. The EU has a completely different pattern (Figures 4.1-4.5).
- There is little evidence in job adverts that positions migrate to different regions after countries limit activities or institute bans on crypto (Figure 5).
- There is a perceived identification of software engineering expertise with knowing one programming language. There is also a perceived difference in status: software engineers perceive finance positions as being of higher status than their own, especially in Asian firms. This can impede effective collaborations.
- Software engineers who have worked for trading platforms appear to have more financial expertise than finance professionals have engineering expertise.

Why expertise in crypto and blockchain?

In the last two years, cryptocurrency and blockchain firms have grown into a $3tn-plus industry. Governments, regulators, and major financial and industrial players are at various stages of planning and/ or implementing their own distributed ledger and blockchain solutions. We are currently experiencing a surge of imaginings and strategizing with regard to possible outcomes of ever wider adoption of blockchain technology. Developments to date and predicted trajectories merit that we investigate in more depth who makes up these spaces in terms of expertise.

Understanding how expertise is currently being shaped in the fields of cryptocurrency and blockchain is key to understanding both how this area currently functions and how it will

evolve in the future. It is also key for realising, at a policy level, what might be needed in terms of education and training for future generations.

Few papers have paid attention to expertise in the crypto and blockchain spaces, and how experts collaborate with each other.

We aim to close this gap by offering insights on the following questions:

- What major roles do professionals occupy in these firms?
- How do experts work together in the blockchain space? Do areas of expertise such as finance and software engineering truly overlap?
- How do experts perceive each other?

Our investigation

We draw on the following: (1) more than 170 in-depth interviews with finance professionals, managers, and software engineers in the blockchain and cryptocurrency space to present a picture of the current and anticipated state of expertise and development in this area. We have reached out to firms globally, including the UK, the greater European area, the US, Canada, China, Hong Kong, and Japan. (2) an analysis of LinkedIn adverts for positions in blockchain and cryptoasset relevant firms, as well as of the Crunchbase dataset. While LinkedIn job adverts have limitations (e.g, LinkedIn has been pulled off in China in October 2021; east Asian countries might use other recruitment platforms as well), we believe that an analysis of its job adverts has value. The insights gained from the analysis are corroborated by the interviewees' feedback and by observations in online meetings.

This work is part of a research project based at the Future of Financial Work Research Centre, King's Business School, King's College London, "Professional Hybridisations and Epistemic Practices of Cryptocapital: An Ethnographic Investigation of Cryptoasset Firms," funded by the Economic and Social Research Council UK.

Professional roles in blockchain

Currently, the blockchain ecosystem comprises cryptographic proof infrastructure, blockchain (layer one protocol), exchanges and second layer market financial facilitators, and other application layers. The making of a blockchain system requires skills and expertise

ranging from data centre operator, cryptographer, software engineer, microeconomist, to financial expert (e.g., venture capital, risk managers, traders). For anything in this area to function, both software engineering expertise and financial expertise are necessary.

As the industry attracts capital and expands, the need for *specialized blockchain developers* grows (see also Table 1). These are professionals who can develop complex layer one blockchains or work with existing blockchain protocols to develop or implement new applications, such as wallets, stable coins usage, and decentralised finance (Defi- Onchain decentralised financial projects). With the emergence of Defi and Gamefi this year, more companies and start-ups are looking for Defi developers to develop smart contracts, Defi and Gamefi projects.

Many of our interviewees worldwide have emphasized the shortage of critical blockchain engineering skills and the very limited availability of specialized professionals. This has led to a number of choices with respect to how blockchain firms are organized and work. It stands in contrast with the availability of finance professionals and signals an asymmetry that is consequential with respect to how knowledge is transferred.

Finance experts range from venture capital to risk management on cryptoasset platforms to insurance and supply finance. While we have repeatedly heard about the difficulty of recruiting blockchain specialists, we haven't heard about any difficulties in the recruitment of finance experts.

Depending on cryptographic proof and consensus mechanism, a blockchain project may need to be able to attract node operators. *Community builders* are considered crucial in communicating what the project has done, facilitating, maintaining, and vitalising future projects. These are often specialised professionals involved in the use of social media, in particular Twitter, Discord or Telegram.

There may also be a need for *project incubators*, business developers to operate new projects being plugged into the blockchain and attract capital to them.

Table 1. Types of firms and roles (firms may be involved in multiple types of business listed above)

Type of firms in the ecosystem	Roles for proprietary functions
Layer one public chain (Public chain, Private chain, Consortium blockchain)	Tech team (software engineer for various functions), Business Development, Cryptographer, Marketing, Community builder and operation, Investment
Applications (Wallet, Stable coin usage, Defi, Gamefi, data on-chain, Government or industry data on-chain project)	Software engineers (software engineer for various functions), Business Development, Product managers
Exchange (Central, Decentralised exchange, Market making, OTC)	Tech team, Business Development, Trading, Operations, Investment
Infrastructure (Data centre operator/Miners, Mining Pool)	Tech team, Business Development, Operations, Investment

Learning and expertise

Blockchain-specific engineering skills are not necessarily either taught in software engineering courses or acquired by software engineers over the course of their careers in other fields. For example, software engineering expertise and knowledge about layer one protocol are not equally distributed. Different blockchain firms require different types of software engineering skills, some more focused on front-end than back-end development. Developing a public blockchain requires investment in research and development. Designing and implementing a consensus mechanism involves realising a hash function to verify data, going through security considerations or designing a DAO for community members to vote for economic parameters on the blockchain. There are firms innovating in this area. Some develop alternative blockchain types or change the size of each block. Many existing blockchains try to improve the Transaction Per Second (TPS) using the same consensus framework as Bitcoin and Ethereum.

Programming languages for blockchain tend to differ from those used in regular software engineering roles, with new languages being used for smart contract development and other applications on Ethereum (see also Figure 1). This contrasts with other, more general-purpose languages such as Python that are commonly used in other industries, or in managerial, analyst, or trader roles. Further complicating this matter is that different chains also require knowledge of different programming languages. This means that the more

specialised the blockchain or crypto project, the more specific the technical knowledge and the less likely it is that a software engineer transitioning from a different industry will have this technical knowledge. This means that many software engineers in the blockchain space are learning as they go.

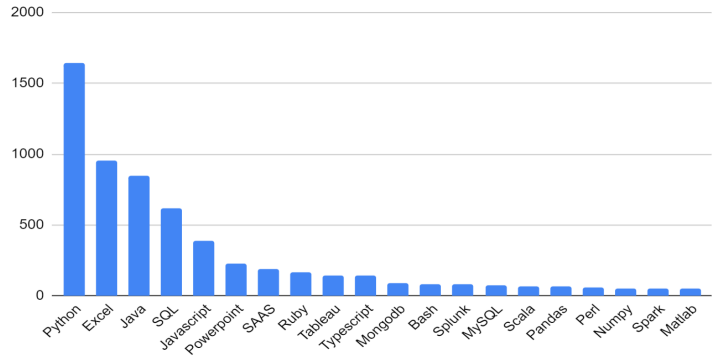
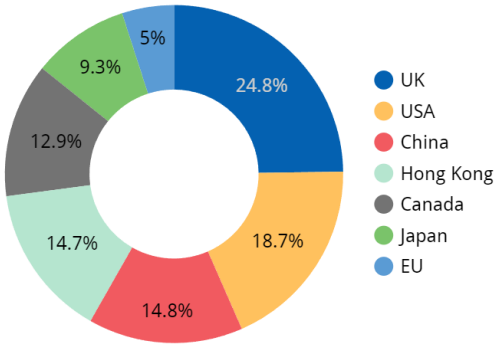


Figure 1. Top 20 language tools appearing in LinkedIn job adverts for blockchain and crypto

Figure 1 shows the top 20 language tools appearing in LinkedIn job adverts for the blockchain and crypto industry in 2021. As we show below, a majority of job adverts are for positions other than engineer. This explains the preponderance of Python, Excel, Java/ Javascript and SQL. There is considerable variety across more specialized languages in demand, indicating the degree of specialization required by blockchain projects on the engineering side.

Accounts of the interviewed engineers point to the fact that specialized blockchain engineering expertise (especially research-related) is largely concentrated in Silicon Valley, i.e. the geographic region south of San Francisco, CA. This explains the recruitment difficulties encountered in the UK, Europe, but also in Asia (Japan, HK, mainland China). The same accounts point to the fact that when it comes to mainland China the bulk of the expertise is located in Shenzhen, with significantly less in Beijing and Dalian.

The distribution of demand for expertise



There were **14,012 LinkedIn job adverts** in the crypto economy in 7 regions of the world over **one year period, December 2020 – December 2021**. The UK has the largest share of crypto job adverts, at almost a quarter, whereas the EU is the smallest among these, at 5%. The US have the second largest share at 18.7%. Hong Kong's share of advertisements is 14.7%, followed closely by Canada at 12.9%. China stands at 14.8%. Advertisements from Japan represent 9.3% of the total.

Figure 2. The distribution of LinkedIn job adverts in the crypto and blockchain economy, 2021

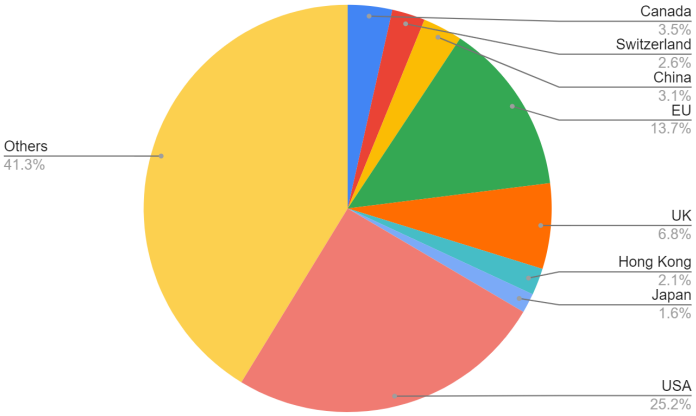


Figure 3 shows the distribution of blockchain and crypto companies around the world (based on Crunchbase data). The UK has almost 7%, yet generates almost a quarter of all job adverts, which points at industry growth. Canada, USA, Hong Kong, and China also seem to be major job creation drivers, while EU firms apparently generate fewer jobs relative to their global share in the blockchain industry.

Figure 3. The distribution of blockchain and crypto companies around the world, 2021, based on Crunchbase data

Figures 4.1-4.5 below illustrate the variations across five countries in the main positions being sought. The top job titles that are advertised for are: manager, trader, analyst, and engineer, followed by sales or operations associate. However, there are significant differences across firms. In the UK, in demand are traders, managers, analysts and engineers (in this order), while in the USA the demand for analysts and engineers seems to be higher compared with the UK. Hong Kong and China have very similar demand profiles. The EU is a standout as the demand for software engineers seems to be significantly higher as a % of total job adverts, when compared with any other country or region we have examined. This cannot simply be explained by non-EU firms outsourcing software engineering to the EU. The very restricted supply of expertise in the EU has also been expressed by several interviewees.

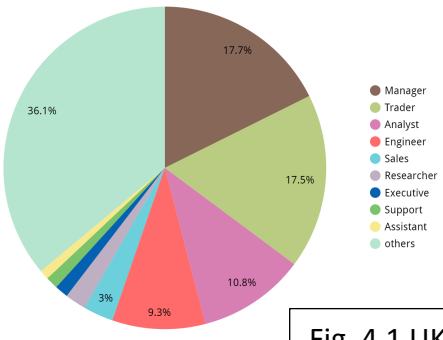


Fig. 4.1 UK

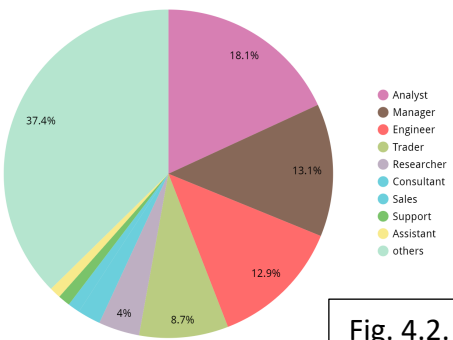


Fig. 4.2. USA

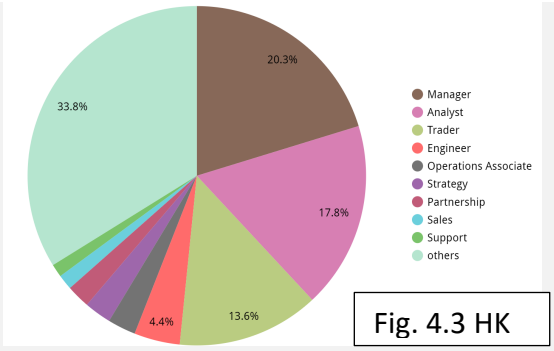


Fig. 4.3 HK

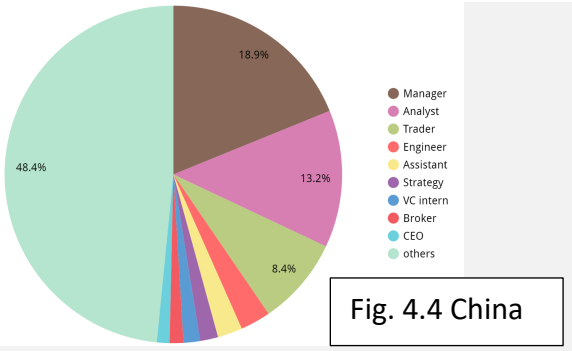


Fig. 4.4 China

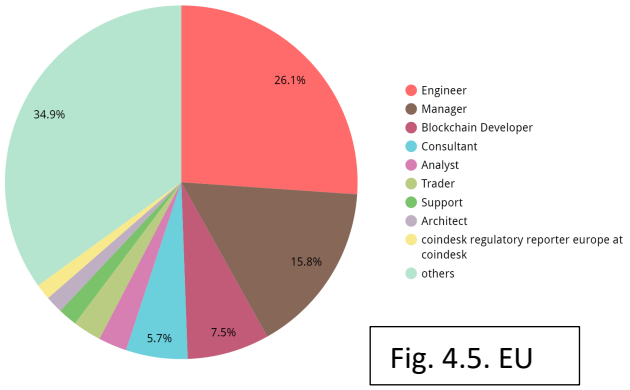


Fig. 4.5. EU

Figures 4.1-4.5. Main job titles by country/ region

Over the course of 2021, between a third and half of job adverts monthly came from the UK and the US (Figure 5). The seasonal variations (with a slump in July 2021—a time when Bitcoin reached a low) can be attributed not only to hiring cycles, but also to political and regulatory events. We notice an uneven pickup in August and September 2021, as well as the fact that the July slump does not seem to impact the UK. (We cut off at October 2021, when LinkedIn leaves China.) China's banning of all crypto trading in September 2021 seems to have had a limited impact on job openings in the industry. US and UK continue to be dominant in crypto and blockchain job creation. Within the European context, the UK appears to play a much bigger role than the EU.

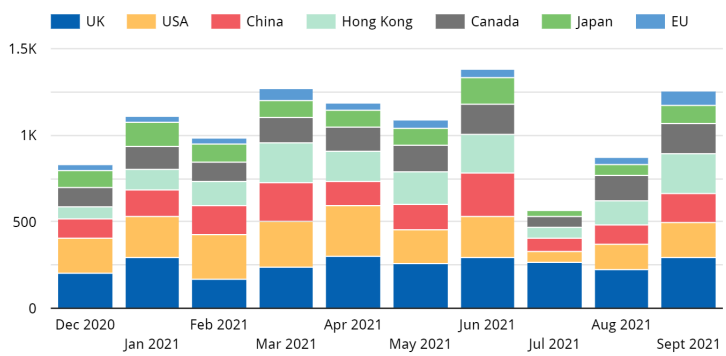


Figure 5. LinkedIn job postings in the crypto and blockchain industry by month and region

The distribution of expertise

We have already pointed to an unequal distribution of the demand for expertise in blockchain firms: specialized engineering expertise is highly concentrated and does not overlap with the distribution of general software engineering expertise. Financial expertise is concentrated, but not necessarily in the same locales with blockchain engineering expertise. We have encountered blockchain firms that outsource their software engineering to another location, partly motivated by lower costs, and partly by the availability of expertise. Vietnam, Eastern Europe, Ukraine, and Russia are a draw because of a highly skilled software engineering labour force. For example, many Japanese and Hong Kong firms set up engineering departments in Vietnam (Ho Chi Minh City). Hong Kong firms might choose to use engineering expertise located in Shenzhen as well. Interviewees pointed to an imbalance of the ratio engineering:finance expertise in Shenzhen/ Hong Kong. Interviewees from the UK though expressed less interest in locating engineering expertise in Eastern Europe, as London is the biggest center of such expertise in Europe; what is in short supply is specialised blockchain expertise. This is entirely consistent with what the analysis of job adverts tells us: firms located in Hong Kong, for instance, will create jobs, for some of which Vietnam-based experts will be recruited. The outsourcing of software engineering expertise to other geographical locations has an impact on collaborations, on multiple levels.

Collaborations between software engineers and finance professionals in blockchain firms

While collaborations are often praised in theory, in practice they are not easy at all. This was underscored time and again by our interviewees. Among the major issues perceived as impacting collaborations were:

1. *Perceived difficulty of understanding blockchain technology puts off finance professionals*. Even managers with an engineering background and longstanding experience in technology-driven organizations considered that blockchain technology and consensus protocols are difficult to understand. This can lead to finance professionals being indifferent toward such an understanding: one of our

interviewees, who was at the time the COO of a major cryptoasset platform stated that she doesn't need to "know how the sausage is made."

2. *Perceived identification of software engineering expertise with knowing one programming language*. Many of the interviewed finance experts and managers considered that software engineering expertise means knowing (just) one programming language, preferably Python. This stands in stark contrast with the diversity of languages needed (see Fig. 1), the complexity of software engineering in blockchain, as well as with the self-understanding of blockchain software engineers. Few of the managers we interviewed were aware of the complexity of blockchain software engineering.
3. *Asymmetric knowledge due to different trajectories*. Many of the engineers we interviewed had acquired financial expertise due to previous work for trading platforms. They knew not only the terminology of trading, but the logic of various trading instruments (e.g, what a derivative product is and how it works). Even if they were not specialists in blockchain and had to adapt, it was easier for them to do so because they understood this logic and could adapt crypto assets to it. However, when it came to areas such as project finance, software engineers did not have a similar grasp. Financial experts by contrast did not usually have a grasp on the logic of engineering (e.g., coding a trading algorithm) and *did not consider it to be important*.
4. *Privileging terminology over logic*. Many of the managers and finance experts we have interviewed privileged acquiring a vocabulary over the logic of engineering. This stands in contrast with engineers who had work experience for trading platforms and understood the logic of various trading instruments.
5. *Competing logics in evaluating and conducting projects*. Some of our interviewees highlighted that evaluating and conducting a project implies working along two logics: that of financial value (as expressed in costs and benefit computations, or in estimating the financial value of certain assets) and that of technological value. These logics are not always aligned, and each type of expertise tends to privilege one over the other. The logic of financial value has a shorter horizon compared with that of technological value, yet more often than not determines capital investments. These logics can clash for instance when it comes to evaluating new functionalities for a trading platform versus stabilizing existing functions. These clashing logics were seen

as an obstacle to collaboration especially in big banks involved with blockchain projects.

6. *Teamwork vs. individual work*. Software engineers work in small teams while finance experts work either individually or within hierarchical responsibilities. This impedes collaboration, especially if software engineering is outsourced. In that case, engineering teams will coordinate internally but less so with the finance professionals based in a different location.
7. *Perceived differences in status*. While finance professionals and managers considered that in their work contexts there was no difference in status between them and software engineers, many of the software engineers we have interviewed considered that there were significant differences in status between the two professions in their work contexts, and that generally finance professionals were treated as higher than them. This was especially marked in the Asian contexts where we have conducted interviews (Japan, Hong Kong, mainland China). Software engineers in these contexts considered that software engineers in Western Europe and North America have a higher status compared with them. In other words: while finance professionals might consider that they treat engineers as of equal status, engineers do not share this view. The gap between these perceptions impacts readiness to collaborate, as well as the feeling that the counterpart understands well what engineers are trying to convey (see also #1 above).

Are intermediaries useful?

The above aspects show that it is not easy to collaborate across expertises in blockchain firms. Some of our interviewees, but not all considered that intermediaries can alleviate collaboration problems. These roles are tasked with operating across expertise boundaries. They may be responsible for clearly explaining the business requirements to a team of software engineers while also being able to relay the technical constraints and difficulties encountered by the tech team back to management.

Intermediaries are seen to have just enough financial and technical literacy to be able to speak the language of both domains. However, as many of our interviewees have stated, knowing financial and/ or engineering terminology is not enough. Critical is grasping the logic

of a technology or of a financial product. Often, the knowledge and expertise of intermediaries are the result of their own particular career path, possibly straddling both technical areas (such as data science or writing code) and finance.

Conclusion

Taking job adverts as a proxy for the growth of the crypto economy, we see that this growth has continued over 2021, with the exception of a slump in July 2021, possibly related to a slump in the price of Bitcoin. (This warrants further investigation.) Countrywide bans on crypto trading seem to have a limited effect, and we do not see in job adverts a wholesale migration to other regions/ countries, as it has been speculated in the media. As expertise is unequally distributed though, some software engineering jobs might be outsourced to Eastern Europe or Vietnam. We introduce a caveat though as LinkedIn job adverts have their limitations as a proxy for industry growth.

We see an asymmetry in the reciprocal understanding of software engineering and financial expertise, which impacts collaborations: software engineers with experience on trading platforms have an understanding of the logic of financial assets, not just of terminology. For other areas such as project finance, this is less the case. On their side, finance professionals tend to equate software engineering with knowing a programming language and consider blockchain to be difficult to grasp. The perceived identification of software engineering with knowing Python is misleading and needs to be countered. All this, compounded with perceived status differentials and with the asymmetric location of jobs can lead to challenges in collaboration. A possible solution is intermediation—that is, project or product managers that intermediate between software engineering and finance experts. Crucial for successful intermediation is a grasp of both logics (i.e., finance and engineering) rather than just vocabulary.