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An exploratory study of the FinTech (Financial Technology) education and retraining in UK

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An exploratory study of the FinTech (Financial Technology) education and retraining in UK

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Abstract

Purpose – The purpose of this paper is to explore two identified knowledge gaps: first, the identification and analysis of online searching trends for Financial Technology (FinTech)-related jobs and education information in UK, and second to assess the current strength of the FinTech-related job distribution in terms of job titles and locations in UK, job market in UK and what is required to help it to grow.

Design/methodology/approach – Two sets of data were used in this study in order to fill the two identified knowledge gaps. First, six years' worth of data, for the period from September 2012 to August 2018 was collected from Google Trends. This was in the form of search term keyword text. The hypothesis was designed correspondingly, and the results were reviewed and evaluated using a relevant statistical tool. Second, relevant data were extracted from the "Indeed" website (www.indeed.co.uk) by means of a simple VBA programme written in Excel. In total, the textual data for 500 job advertisements, including the keyword "FinTech", were downloaded from that website.

Findings – The authors found that there was a continuously increasing trend in the use of the keyword "fintech" under the category "Jobs and Education" in online searching from September 2012 to August 2018. The authors demonstrated that this trend was statistically significant. In contrast, the trends for searches using both "finance" and "accounting" were slightly decreased over the same period. Furthermore, the authors identified the geographic distribution of the fintech-related jobs in the UK. In regard to job titles, the authors discovered that "manager" was the most frequently searched term, followed by "developer" and "engineer".

Research limitations/implications – Educators could use this research as a reference in the development of the portfolio of their courses. In addition, the findings from this study could also enable potential participators to reflect on their career development. It is worth noting that the motivations for carrying out an internet search are complex, and each of these needs to be understood. There are many factors that would affect how an information seeker would behave with the obtained information. More work is still needed in order to encourage more people to enter to the FinTech sector.

Originality/value – In the planning stage prior to launching a new course educators often need to justify the market need: this analysis could provide a supporting rationale and enable a new course to launch more quickly. Consequently, the pipeline of talent supply to the sector would also be benefitted. The authors believe this is the first time that a study like this had been conducted to explore specifically the availability and opportunities for FinTech education and retraining in UK. The authors anticipate that this study will become the primary reference for researchers, educators and policy makers engaged in future research or practical applications on related topics.

Keywords FinTech, Financial Technology, Higher education, Retraining, Business innovation

Paper type Research paper

1. Introduction

Financial Technology (FinTech) is a cross-disciplinary subject that combines Finance, Technology Management and Innovation Management. FinTech initiatives often lead to new business models or even new business (Leong and Sung, 2018).

FinTech is a promising area in the business world. As per Pollari and Ruddenklau (2018), Global fintech funding rose to $111.8bn (£88.2bn) in 2018, which is an increase of 120 per cent when compared to $50.8bn (£40.08bn) in 2017. According to Gulamhuseinwala *et al.* (2017), 222 FinTech companies had received an average investment of £15m or £2.9bn in aggregate globally in the years up to 2017.

Researchers have also studied the intentions of users when changing their domestic currency for a digital currency (Glaser *et al.*, 2014), and discussed whether Bitcoin would become a major currency (Luther and White, 2014). In the real market, the total crypto-currency market capitalization has increased more than three times since early 2016, reaching nearly $25bn in March 2017 (Hileman and Rauchs, 2017).

Financial technology companies are developing everywhere, especially in the payments market (Mckinsey & Company, 2016). According to Zion market research (2018), the global mobile phone payment technology market is expected to reach a value of approximately £2,660.87bn by 2024.

The development of Fintech capabilities and related technologies has also facilitated the emergence of start-ups that offer alternative sources of financial service (Fenwick *et al.*, 2017). Zhang *et al.* (2018) found that the total value of the alternative finance market in the UK grew by 35 per cent to £6.2bn during 2017. Crowdfunding is such a type of alternative method of generating finance and the total global crowdfunding industry was equivalent to GBP 27bn in 2015, that is, 2.1 times higher than the figure for 2014 (Massolution, 2015).

UK is one of the leading countries in the World in terms of FinTech development. In August 2014, Chancellor of the Exchequer, George Osborne, announced the UK Government's ambition to make UK the "global capital of FinTech" (Kotecha, 2016). According to Ben *et al.* (2018), London is the number one pioneer in regulation, one of the top three in the ecosystem, and ranked third in market value among the global FinTech hubs. In addition, as at April 2019, there are more than 1,600 FinTech firms registered as businesses in the UK, and estimates that this will be more than double by 2030 (Helm *et al.*, 2019).

As a result of the increasing investment in the UK, Innovate Finance (2015) estimated that the FinTech sector would help to create an additional 100,000 jobs in the UK by 2020. On the other hand, in conjunction with WPI Economics, Innovate Finance published a research report in April 2018 which suggested the UK FinTech workforce is set to double, in line with the expansion of the sector to include approximately 3,300 firms by 2030 (Oakley *et al.*, 2018).

The rest of the paper is organised as follows. Building on the selected literature reviewed in Section 1, we identify the research gaps in the sector and discuss the potential impacts of the gaps in Section 2. In Section 3, we explain the research design and related background. The findings of the analyses are reported in Section 4. Section 5 provides discussions and recommendations for future works.

2. Research gaps in the sector

Although the emergence and development of FinTech and the demand for FinTech talents and skills have widely been studied nationally and internationally as introduced in Section 1, there has been little investigation into the interests of information seekers regarding FinTech-related jobs and education. This topic and related analysis is important for the health of this growing sector, where the increased demand for skills must be met, as well as for the educators who want to launch corresponding education and training programmes in the sector. For example, in the planning stage prior to launching a new course, educators need to demonstrate the market requirement and to make a business case of the development costs of that course.

Without such analysis as a support, the launch of new courses would be delayed and consequently, the pipeline of talent supply to the sector would be affected.

In addition, only very few studies have been conducted in regard to the job and skillset needs related to FinTech. Although there was a report (Gulamhuseinwala *et al.*, 2017) indicating that attracting suitable and qualified talent is one of the top three challenges for the industry, with access to coding and software skills being of particular concern, the findings were limited to feedback obtained from UK FinTech firms only. In other words, the findings did not include opinion obtained from non-FinTech firms. Given that FinTech is an aspect that applies to every business (Leong and Sung, 2018), we considered that a broader study was needed to fill the knowledge gap. In fact, the understanding of the job market could help educators to equip future talents more appropriately to fulfil the range of needs within the broader sector.

This study aims to fill the two knowledge gaps identified above, they are:

(1) Online searching trends for FinTech-related jobs and education information in UK.

(2) FinTech-related job distribution in terms of job titles and locations in UK.

The research design is discussed in following section.

3. Research design

In this study, we used a public accessible online tool, Google Trends (www.google.com/trends/) to analyse the online searching trends on FinTech-related jobs and education information (research gap (1)).

Google Trends is a free public web service developed by Google. It shows how often specific search terms have been queried over a specific period of time. A search term is a keyword that a user enters the Google search engine to satisfy his or her information needs. The data provided by Google Trends is updated daily and it is possible to query up to five search terms simultaneously according to the predefined time period and geographical location.

Google Trends has been considered as a source of big data and the data from Google Trends has been used by researchers for analysing human behaviour and user interests across various fields (Jun *et al.*, 2018). For example, Ginsberg *et al.* (2009) published their findings in Nature and reported that they successfully used the data from Google Trends to predict the spread of influenza epidemics – even earlier than the Centers for Disease Control and Prevention. Choi and Varian (2012) demonstrated how to use search engine data on Google to forecast near-term values of economic indicators, such as unemployment claims, consumer confidence, etc. The works of Vosen and Schmidt (2011) suggested that incorporating information from Google Trends could offer significant benefits to forecasters of private consumption. Durmusoglu (2017) demonstrated the uses of Google trends data to assess public understanding on the environmental risks.

On the other hand, in order to understand FinTech-related job distribution in terms of job titles and locations in UK (research gap (2)), we used an online data extraction technique called "web scraping" approach to extract the open data from the job posts on Indeed (www.indeed.co.uk/). According to the official information from Indeed, this website is one of the most popular job sites in the world with over 250m unique visitors every month. A simple VBA programme written in Excel was used for scraping textual data for 500 job advertisements on indeed, with the keyword "FinTech".

In fact, using web scraping to collect online open data can help to generate new knowledge. For example, by combining web scraping and analysing skill, Boeing and Waddell (2017) reported new Insights into Rental Housing Markets across the USA.

4. The results of analyses

Two analyses were conducted in this study as follows.

4.1 On analysing online searching trends on FinTech-related jobs and education information in UK

In this study, 6 years (from September 2012 to August 2018) of search terms (i.e. keywords) data were collected from Google Trends. More specifically, the search terms were "fintech", "finance" and "accounting". By specifying the category "Jobs and Education" in Google Trends, we filtered the results to specified category (i.e. Jobs and Education) only and enhancing the accuracy of analysing results. It is worth mentioning that the data collected from Google Trend in this research is NOT about job advertisement in the finance related positions. Instead, the data collected refers to the search behaviour of Google search engine users, that is, what these users are looking for over a specified period and the location of the search was conducted. More specifically, in this case, the data refers to how frequent (search volume) Google users in the UK used specified keywords (i.e. "fintech", "finance" and "accounting") to search jobs and education related information.

Figures 1 to 3 demonstrate the "search volume indexes" of the terms "fintech", "finance" and "accounting" from September 2012 to August 2018, respectively. For these figures, the horizontal axis represents time, and the number at the vertical axis is the "search volume index". The index represents search interest relative to the highest point on the chart for the given region (i.e. UK in this study) and time (i.e. from September 2012 to August 2018 in this study). A value of 100 is the peak popularity for the term, while a score of 0 means there was not any search for the term.

As per Figure 1, the trendline in the chart of "fintech" illustrated the left-hand side (more earlier in terms of timeline) is much lower than the right-hand side (more recent in terms of timeline), this indicates an increasing trend for the search term "fintech". In contrast, both the trendlines in the charts of "finance" and "accounting" (Figures 2 and 3) illustrated the
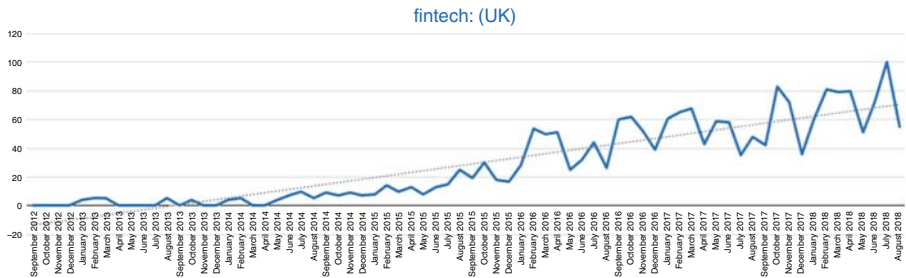

Figure 1.
Searching trend of the term "fintech" from September 2012 to August 2018
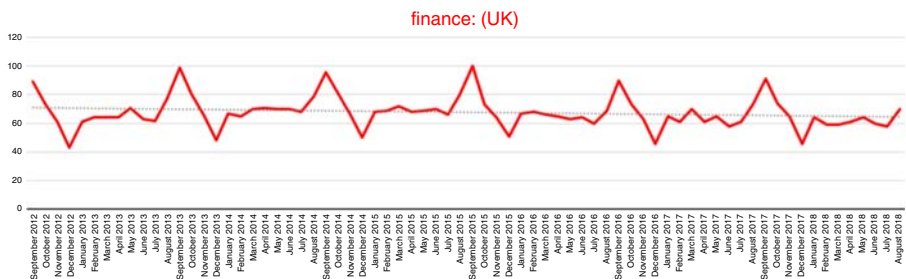

Figure 2.
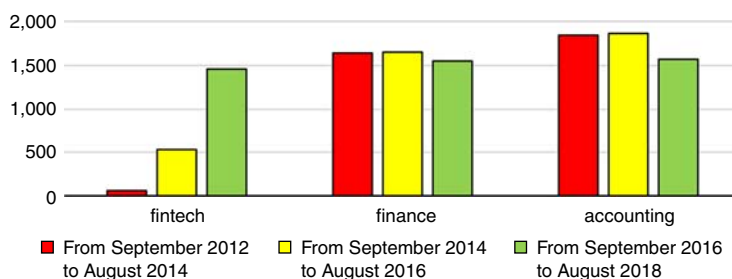Searching trend of the term "finance" from September 2012 to August 2018

left-hand sides (more earlier in terms of timeline) are slightly higher than the right-hand sides (more recent in terms of timeline), that means the overall search volume of both terms "finance" and "accounting" had been dropped slightly during the same period. These patterns demonstrate that there has been an evolution in the search terms used for fintech-related jobs and educations in the UK.

Figure 4 shows the "accumulated search volume indexes" of the terms "fintech", "finance" and "accounting" during the periods from Sep 2012 to Aug 2014 (in red), from September 2014 to August 2016 (in yellow) and from September 2016 to August 2018 (in green).

In Figure 4, we observed obvious changes of searching patterns for the term "fintech". The increasing trend of searching pattern reflects how UK's Google users' behave in response to the impacts of FinTech on financial industry. Previous studies have found strong association between online searching behaviour and various social topics in the real world, such as flu prevention (Ginsberg *et al.* 2009), investor attention and IPO anomalies (Song *et al.*, 2011), forecasting of cinema visits (Hand and Judge, 2012), etc. Recent years, FinTech is an emerging topic and is changing the financial ecosystem. For examples, Gomber *et al.* (2017) had indicated that financial industry has experienced a continuous evolution due to digitalization. Lee and Shin (2018) explained that FinTech is a disruptive innovation capable of shaking up traditional financial markets while Romānova and Kudinska (2016) further explained the rapid rise of FinTech has changed the business landscape in banking. Moreover, Chuen *et al.* (2015) suggested that FinTech will define and shape the future of the financial services industry, and at the same time, increase participation. According to the findings of Gulamhuseinwala *et al.* (2015), 15.5 per cent of digitally active consumers are using FinTech products. Furthermore, Chen (2016) suggested that FinTech facilities the integration between finance and real-life needs.

Figure 3.
Searching trend of the term "accounting" from September 2012 to August 2018

	fintech	finance	accounting
From September 2012 to August 2014	58	1,645	1,856
From September 2014 to August 2016	532	1,664	1,880
From September 2016 to August 2018	1,462	1,557	1,579

Figure 4.
Accumulated searching volume of the terms "fintech", "finance" and "accounting"

In overall, the changes of financial ecosystem lead to increasing demand of related information need through internet, consequently, the demand drives an increasing trend of search patterns for the term "fintech". In order to evaluate if the change is significant. We, therefore, hypothesize:

H1. The online searching volume of FinTech-related jobs and education information had changed significantly in UK.

As mentioned previously in this paper, the Chancellor of the Exchequer, George Osborne, announced the UK Government's ambition to make the UK the "global capital of FinTech" (Kotecha, 2016) in August 2014. Therefore, three periods (i.e. red, yellow and green) were used to represent 3 different stages related to the announcement: Stage 1 is the period from Sep 2012 to Aug 2014 (in red), referring to the two-year period "before" the announcement. Stage 2 is the period from September 2014 to August 2016 (in yellow); it indicates the two-year period "after" the announcement. A comparison between Stage 1 and Stage 2 shows the changes of search volumes on corresponding terms before and after the announcement. In brief, the search volume of "fintech" had increased from 58 to 532 (817 per cent increase) from Stage 1 to Stage 2; however, the search volumes of the other two terms, "finance" and "accounting", were constant. Moreover, Stage 3, the period from September 2016 to August 2018 (in green), represents the "follow-up" two-year period after Stage 2. It reflects another increase from 532 to 1,462 (175 per cent increase) of search volume from Stage 2 to Stage 3, indicating that this growth is continuous instead of one-off.

Recall that in *H1*, we proposed "the online searching volume of FinTech-related jobs and education information had changed significantly in UK". We then suggested the null hypothesis (i.e. the expectation) as opposite situation, that is:

H0. The online searching volume of FinTech-related jobs and education information had not increased significantly in UK.

For each comparison, we applied χ^2 test as statistical test to determine if there is a significant difference between observed and expected frequencies. The expected frequency of the stage at each comparison is evenly distributed between two stages, that is, assuming there is no change from one stage to another.

According to the χ^2 test results, as presented in Tables I and II, we found statistical significance results of the changes between Stages 1 and 2 ($\chi^2 = 227.038$, $p < 0.01$) and between Stages 2 and 3 ($\chi^2 = 229.348$, $p < 0.01$) (df $= 1$). Therefore, the null hypothesis, H_0, for both tests should be rejected. These results support the conclusion that the search volume of FinTech-related jobs and education information had increased significantly in the UK.

4.2 On analysing FinTech-related job distribution in terms of job titles and locations in UK
The Indeed website contains textual information about job vacancies; see, for example, Figure 5. For this research, we analysed 500 job titles, and their corresponding locations, which included the keyword "FinTech".

Table I.
χ^2 test results of the comparisons on Google search volume for the term "fintech" between September 2012 – August 2014 and September 2014 – August 2016

Categories	Observed O_i	Expected E_i	χ^2 component $(O_i-E_i)^2/E_i$
From September 2012 to August 2014	58	295	190.40
From September 2014 to August 2016	532	295	190.40
Total	590	590	380.81

Notes: The χ^2 statistic is 227.038. The *p*-value is 0.0000

A simple VBA programme was written on Excel in order to extract the relevant data from Indeed website.

We executed the programme on 11 June 2019, 12.39 p.m. We found that the majority of the jobs were located in London (63 per cent). Table III summaries the top 10 locations of the jobs and Figure 6 is a colour gradient heat map that shows the distribution of the jobs in which red refers to having highest density of jobs, followed by yellow and then green. Table III and Figure 6 reflect the FinTech-related job opportunities across UK, and therefore this can inform job seekers as to where there is greater demand for FinTech-related jobs available.

In addition, we also conducted a textual analysis to evaluate which keywords are most likely to be used in the job titles. After excluding the punctuation marks, and transition words (e.g. "and"), we identified the 20 most frequent keywords, shown in Table IV. This information could be used as a reference for various purposes in education and training.

Categories	Observed O_i	Expected E_i	χ^2 component $(O_i-E_i)^2/E_i$
From September 2014 to August 2016	532	997	216.88
From September 2016 to August 2018	1,462	997	216.88
Total	1,994	1994	433.75

Notes: The χ^2 statistic is 229.348. The p-value is 0.0000

For example, taking note of the fact that "manager", "developer" and "engineer" are the top three most frequent keywords, an educator might include a greater content of management or coding skills in the curriculum of related courses, in order to meet the market needs.

5. Discussion and recommendations for future works

Digital transformation is changing many industries all over the world in different ways, such as health (Agarwal *et al.*, 2010), policing (Wall and Williams, 2007), crime prevention (Leong and Chan, 2013), marketing (Mulhern, 2009), product life-cycle management (McMillan *et al.*, 2017), etc. In financial industry, Fintech has disrupted and is disrupting the whole industry. Particularly, it has significant impacts on the related job market.

Rank	Location	Counts	% (out of 500)
1	London	315	63
2	Reading	13	3
3	Cardiff	10	2
4	Farringdon	10	2
5	Belfast	9	2
6	Edinburgh	9	2
7	Liverpool	9	2
8	Manchester	9	2
9	Fareham	5	1
10	Slough	5	1

Table III.
Fintech Job
distribution
by location
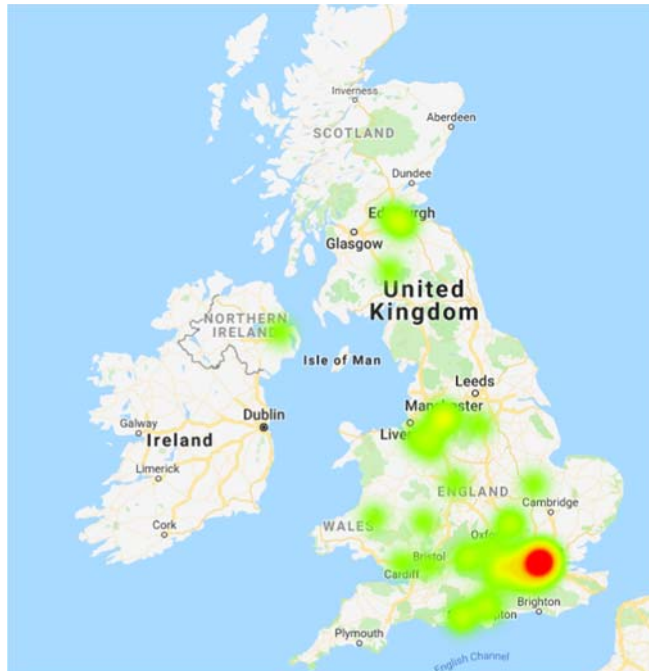
Figure 6.
FinTech job
distribution in the UK

Source: Google Maps

Rank	Keywords	Count
1	Manager	84
2	DEVELOPER	79
3	Engineer	78
4	Fintech	71
5	Senior	70
6	Business	41
7	Analyst	40
8	Data	29
9	Software	27
10	Java	27
11	Lead	26
12	Sales	24
13	Product	24
14	Development	24
15	Executive	23
16	Support	20
17	Marketing	20
18	DevOps	20
19	Customer	18
20	Financial	17

For example, Vikram Pandit (former Citigroup Chief) predicted that 30 per cent of banking jobs could be wiped out by Artificial Intelligence (AI) in five years (Chanjaroen, 2017), while Mizuho Financial Group in Japan says it will use AI to replace 19,000 people by 2027 – about a third of its workforce (Gopalan, 2019). On the other hand, as per Helm *et al.*, (2019), there were 76,500 people working in FinTech UK-wide, but the number is set to grow to 105,500 by 2030.

Therefore, there are emerging requirements for developing the education and retraining sector for existing and potential finance participators.

In this paper, we have evaluated 6 years (from September 2012 to August 2018) of search terms (i.e. keywords) data from Google Trends and identified continuous increasing searching trends of the keyword "fintech" under the category "Jobs and Education". Over the same period, both the searching trends of "finance" and "accounting" were slightly decreased. Moreover, we found that the increasing searching patterns of the keyword "fintech" were statistically significant. These findings could serve as a reference for educators when they consider the portfolio of their courses.

In addition, the findings of the geographic distribution of the fintech-related jobs could be used by related educators when they plan job placement arrangements in their courses. Moreover, by analysing the job titles of 500 job FinTech posts on indeed website, we demonstrated that "manager" was the most frequently used term among job titles, followed by "developer" and "engineer". These findings not only provide some insights to educators on designing curriculum, but also enable potential participators to reflect their career development.

It is worth noting that gaining the understanding of the motivation of internet searching is subjected to complexity. Moreover, there are many factors would affect how an information seeker would behave with the obtained information. More works are still needed in order to encourage more people to enter to the FinTech sector. Replication studies with larger samples and in different cultural settings could provide more relevant insights.

In summary, we believe this is the first time that a study like this had been conducted to specifically review online searching trends for FinTech related jobs and education information in UK and FinTech related job distribution in terms of job titles and locations.

Hopefully, the work reported in this paper will be used as a primary reference for researchers, education management and policy makers for future research or practical applications on related topic.

References

Agarwal, R., Gao, G., DesRoches, C. and Jha, A.K. (2010), "Research commentary – the digital transformation of healthcare: current status and the road ahead", *Information Systems Research*, Vol. 21 No. 4, pp. 796-809.

Ben, S., LV, J., Qian, X., Hu, K., Luo, D., Xu, Z., Zhang, P., Sheng, Q., Zheng, Y., Heng, Y., Zhou, H., Zhang, Z., Xu, H., Gu, Y., Xia, Y., Cai, K., Jiang, N., Huang, E., Hao, R., Zhang, B., Wardrop, R., Nan, Q. and Yang, L. (2018), "The future of finance is emerging: new hubs, new landscapes – global FinTech hub report", Cambridge Centre for Alternative Finance, Cambridge, available at: www.jbs.cam.ac.uk/faculty-research/centres/alternative-finance/publications/2018-global-fintech-hub-report/#.XQN9GYhKiUk (accessed 12 June 2019).

Boeing, G. and Waddell, P. (2017), "New insights into rental housing markets across the United States: web scraping and analyzing craigslist rental listings", *Journal of Planning Education and Research*, Vol. 37 No. 4, pp. 457-476.

Chanjaroen, C. (2017), *Pandit Says 30% of Bank Jobs May Disappear in Next Five Years*, Bloomberg Business, New York, NY, available at: www.bloomberg.com/news/articles/2017-09-13/ex-citi-ceo-pandit-says-30-of-bank-jobs-at-risk-from-technology (accessed 12 June 2019).

Chen, L. (2016), "From fintech to finlife: the case of fintech development in China", *China Economic Journal*, Vol. 9 No. 3, pp. 225-239.

Choi, H. and Varian, H. (2012), "Predicting the present with Google trends", *The Economic Record*, Vol. 88, Special issue, pp. 2-9.

Chuen, K., Lee, D. and Teo, E.G. (2015), "Emergence of fintech and the LASIC principles", *Journal of Financial Perspectives*, Vol. 3 No. 3, pp. 24-36.

Durmusoglu, Z.D.U. (2017), "Using Google trends data to assess public understanding on the environmental risks", *Human and Ecological Risk Assessment: An International Journal*, Vol. 23 No. 8, pp. 1968-1977.

Fenwick, M., McCahery, J.A. and Vermeulen, E.P.M. (2017), "Fintech and the financing of entrepreneurs: from crowdfunding to marketplace lending", ECGI Working Paper Series in Law, European Corporate Governance Institute, Brussels, available at: https://ecgi.global/sites/default/files/working_papers/documents/fenwick-mccahery-vermeulen.pdf (accessed 12 June 2019).

Ginsberg, J., Mohebbi, M.H., Patel, R.S., Brammer, L., Smolinski, M.S. and Brilliant, L. (2009), "Detecting influenza epidemics using search engine query data", *Nature*, Vol. 457 No. 7232, pp. 1012-1014.

Glaser, F., Zimmermann, K., Haferkorn, M., Weber, M.C. and Siering, M. (2014), "Bitcoin – asset or currency? Revealing users' hidden intentions", *Proceedings of Twenty Second European Conference on Information Systems*, Tel Aviv.

Gomber, P., Koch, J.A. and Siering, M. (2017), "Digital finance and fintech: current research and future research directions", *Journal of Business Economics*, Vol. 87 No. 5, pp. 537-580.

Gopalan, N. (2019), *This Japanese Megabank Really Needs a Home Run*, Bloomberg Finance, New York, NY, available at: www.bloomberg.com/opinion/articles/2019-03-10/mizuho-can-rebuild-in-japan-after-foreign-bond-losses (accessed 12 June 2019).

Gulamhuseinwala, I., Bull, T. and Lewis, S. (2015), "FinTech is gaining traction and young, high-income users are the early adopters", *Journal of Financial Perspectives*, Vol. 3 No. 3, pp. 16-23.

Gulamhuseinwala, I., Bull, T., Barclay, S., Crosswell, C. and Morgan, D. (2017), *UK FinTech Census 2017: The Voice of FinTech*, Ernst & Young LLP, London, available at: www.ey.com/Publication/vwLUAssets/EY-UK-FinTech-Census-2017/%24FILE/EY-UK-FinTech-Census-2017.pdf (accessed 12 June 2019).

Hand, C. and Judge, G. (2012), "Searching for the picture: forecasting UK cinema admissions using Google trends data", *Applied Economics Letters*, Vol. 19 No. 11, pp. 1051-1055.

Helm, T., Low, A. and Townson, J. (2019), *UK FinTech: State of the Nation*, Department for International Trade, UK.

Hileman, G. and Rauchs, M. (2017), *Global Cryptocurrency Benchmarking Study*, Cambridge Centre for Alternative Finance, Cambridge, available at: www.jbs.cam.ac.uk/fileadmin/user_upload/research/centres/alternative-finance/downloads/2017-global-cryptocurrency-benchmarking-study.pdf (accessed 12 June 2019).

Innovate Finance (2015), *Innovate Finance Manifesto: UK 2020*, Innovate Finance, London.

Jun, S.P., Yoo, H.S. and Choi, S. (2018), "Ten years of research change using Google trends: from the perspective of big data utilizations and applications", *Technological Forecasting and Social Change*, Vol. 130, May, pp. 69-87.

Kotecha, V. (2016), *UK FinTech on the Cutting Edge: An Evaluation of the Intentional FinTech Sector*, EY.

Lee, I. and Shin, Y.J. (2018), "Fintech: ecosystem, business models, investment decisions, and challenges", *Business Horizons*, Vol. 61 No. 1, pp. 35-46.

Leong, K. and Chan, S.C. (2013), "A content analysis of web-based crime mapping in the world's top 100 highest GDP cities", *Crime Prevention and Community Safety*, Vol. 15 No. 1, pp. 1-22.

Leong, K. and Sung, A. (2018), "FinTech (Financial Technology): what is it and how to use technologies to create business value in fintech way?", *International Journal of Innovation, Management and Technology*, Vol. 9 No. 2, pp. 74-78.

Luther, W.J. and White, L.H. (2014), "Can Bitcoin become a major currency?", GMU Working Paper in Economics Nos 14-17, Fairfax, VA, available at: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2446604 (accessed 12 June 2019).

Mckinsey & Company (2016), *FinTechnicolor: The New Picture in Finance*, Mckinsey & Company, New York, NY.

McMillan, A.J., Swindells, N., Archer, E., McIlhagger, A., Sung, A., Leong, K. and Jones, R. (2017), "A review of composite product data interoperability and product life-cycle management challenges in the composites industry", *Advanced Manufacturing: Polymer & Composites Science*, Vol. 3 No. 4, pp. 130-147.

Massolution (2015), "Crowdfunding industry report", Crowdsourcing.org, available at: www.smv.gob.pe/Biblioteca/temp/catalogacion/C8789.pdf (accessed 12 June 2019).

Mulhern, F. (2009), "Integrated marketing communications: from media channels to digital connectivity", *Journal of Marketing Communications*, Vol. 15 Nos 2-3, pp. 85-101.

Oakley, M., Hughes, S., Gulati, S. and Miscampbell, G. (2018), *Supporting UK FinTech: Accessing a Global Talent Pool*, Innovate Finance, London.

Pollari, I. and Ruddenklau, A. (2018), *The Pulse of Fintech 2018*, KPMG, Zurich, available at: https://home.kpmg/content/dam/kpmg/rs/pdf/2018/07/h1-2018-pulse-of-fintech.pdf (accessed 12 June 2019).

Romānova, I. and Kudinska, M. (2016), "Banking and Fintech: a challenge or opportunity?", *Contemporary Issues in Finance: Current Challenges from Across Europe*, Emerald Group Publishing Limited, Bingley, pp. 21-35.

Song, S., Cao, H. and Yang, K. (2011), "Investor attention and IPO anomalies – evidence from Google trend volume", *Economic Research Journal*, Vol. 1 No. S1, pp. 145-155.

Vosen, S. and Schmidt, T. (2011), "Forecasting private consumption: survey-based indicators vs. Google trends", *Journal of Forecasting*, Vol. 30 No. 6, pp. 565-578.

Wall, D.S. and Williams, M. (2007), "Policing diversity in the digital age: maintaining order in virtual communities", *Criminology & Criminal Justice*, Vol. 7 No. 4, pp. 391-415.

Zhang, B., Ziegler, T., Mammadova, L., Johanson, D., Gray, M. and Yerolemou, N. (2018), "The 5th UK alternative finance industry report", Cambridge Centre for Alternative Finance, Cambridge, available at: www.jbs.cam.ac.uk/fileadmin/user_upload/research/centres/alternative-finance/downloads/2018-5th-uk-alternative-finance-industry-report.pdf (accessed 12 June 2019).

Zion Market Research (2018), *Mobile Payment Technology Market by Payment Mode by Technology and by Application: Global Industry Perspective*, Comprehensive Analysis, and Forecast 2017-2024, New York, NY.

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