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DESIGNING THE GUIDELINES FOR FINTECH CURRICULUM

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Abstract. This paper aims to share the experiences of developing the FinTech (Finance Technology) curriculum at a leading business school in the Middle East. This research paper presents the findings on various methodological issues of curriculum design, i.e., degree naming convention, degree structure, dissertation versus project, specializations. The objective of the current study was to develop a postgraduate curriculum for FinTech studies. The entire procedure was based on the notion of "adoption" to "adaptation" originated by the benchmarking approach using a comparative account of 22 universities offering FinTech Masters. A multipronged approach was used to study the existing FinTech curriculum and suggests the gap in the existing curriculum. Eight major areas are identified as the pillars of FinTech education, including FinTech, Business and Data Analytics, Programming using Python and R, Blockchain and Cryptocurrency, Artificial Intelligence, and Machine Learning, Information Systems & Technology, Regulatory Environment (RegTech), Quantitative Methods, Finance and others. Researching on new and emerging topics is always tricky. It is difficult for even FinTech students and aspirants to evaluate the quality of FinTech qualifications. People from different streams of education would like to join FinTech studies, and there is no standardization of professional association certifying FinTech Curriculum.

Keywords: FinTech; Curriculum Designing; Education

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1. Introduction

FinTech could be considered the biggest revolution in the times to come, and it is becoming the most common manifestation of the latest phase of globalization in the modern age. FinTech is a new industry that broadens financial services and uses technology to enable its financial activities (Schueffel, 2016; Knewton et al., 2020, Wojcik, 2021).

FinTech can be defined as "any innovative ideas that improve financial service processes by proposing technology solutions according to different business situations" (Leong, & Sung, 2018). Therefore, the term "FinTech" can be interpreted as the application of information technology in the fields of finance, financial innovation, and digital

innovation, in addition to start-ups or, in other words, the financial service industry outside of banks (Lee & Shin, 2018; Suryono, Budi, & Purwandari, 2020).

The rapid emergence and evolution of financial technology have raised significant concerns for businesses. One example of this is the rise of online loan services, which have caused controversy in various communities (Haddad & Hornuf, 2019; Suryono, Budi, & Purwandari, 2020).

Cryptocurrencies and money laundering were also considered challenges along with the FinTech penetration in the societies, especially in emerging and developing countries where the regulatory framework is not yet ready enough to handle the FinTech industry for example in Indonesia (Davis, Maddock, & Foo, 2017) or in Poland (Kliber, Będowska-Sójka, Rutkowska, & Świerczyńska, 2021). In general, the regulators promote innovation in the financial industry and adopt sound risk management principles to ensure financial services' safety and proper operation (Davis, Maddock, & Foo, 2017).

The emergence of e-finance and mobile technology-enabled financial companies to create new business models and improve efficiency (Lee, & Shin, 2018). The rise of digital banking has created new challenges for traditional financial institutions (Davis, Maddock, & Foo, 2017). For start-ups, this opportunity provided them with a competitive advantage in terms of scale and customer base (Gimpel, Rau, & Röglinger, 2018). Like banks, FinTech also offers various services such as payment and loan services, personal financial consulting, and crowdfunding (Stern, Makinen, & Qian, 2017). Similarly, there are six FinTech business models: Insuretech (insurance services), payment, lending (microfinance), wealth management (personal financial management), capital markets, and crowdfunding (Lee, & Shin, 2018). Therefore, financial literacy is becoming an important factor in the well-being of adults (Panos, & Wilson, 2020).

2. Theoretical background

Much has been written on FinTech and relevant areas, and most of it is within the last seven years. The concept of FinTech is still in its infancy and its offerings are mainly focused less on theoretical underpins and more on a functional perspective (Gimpel, Rau, & Röglinger, 2018). With the emergence of FinTech, it is widely believed that the financial industry is entering a new era of innovation (Lee, & Shin, 2018). The evolution of FinTech has also affected the educational sector. The demand for skilled professionals with a broad range of skills in this field is increasing. This has resulted the educational institutions to offer needed by the rise of FinTech (Kuzmina-Merlino, & Saksonova, 2018).

From the perspective of a periodical timeline, FinTech history can be expanded to four periods: FinTech 1.0, FinTech 2.0, FinTech 3.0, and FinTech 4.0 (Setiawan, & Maulisa, 2020). FinTech curriculum can also be seen evolving on the same footprints.

FinTech 1.0 (1866-1966) is the period when the analog industry was still widely used. It was the first transatlantic cable that was established in 1866, connecting the US to Europe. The financial sector has always been influenced by the various analog technologies that have been used to connect and communicate across borders. This period also marks the first time the credit card was used as a payment instrument (Arner, Barberis, & Buckley, 2015). During this period FinTech curriculum did not exist as a single entity, and all subject areas were considered separate fields of study like electrical engineering, finance, business studies.

FinTech 2.0 (1967 – 2007) is the digitalization of the financial industry that started in 1967. The introduction of the ATM in 1967 is believed to have initiated the digitalization of the financial sector. The emergence of automated clearinghouses and the formation of international financial messaging networks during the 1960s and 1970s provided new opportunities for financial intermediaries and regulators. In 1995, Wells Fargo launched the first internet banking using the protocol www (World-Wide-Web), followed by the emergence of branchless banking in 2005. FinTech 2.0 refers to the various types of financial institutions commonly known as banking

conglomerates and insurance companies (Arner, Barberis, & Buckley, 2017). During this period, all ingredients of today's FinTech curriculum were taught as separate fields of studies in one program with different concentrations like undergraduate programs having a business major with Management Information systems or Information technology as a minor.

FinTech 3.0 (2008 - 2018) is the era of start-ups in the developed world. The evolution of digital innovation has brought about a paradigm shift in how financial services are provided. This shift, which began with the emergence of non-bank financial start-ups, has led to a rethink of how banks are perceived. Following the Asian Financial Crisis in 1997, many financial start-ups started their journey in the same direction. One of these is Paypal, which was established in 1999. Over the years, various companies and institutions launched their digital wallets. In 2005, the launch of ZOPA became the first example of P2P Lending disruption. Some believe that geographical location played a significant role in developing FinTech start-ups during the third generation of the financial system (Arner, Barberis, & Buckley, 2017). During this period, all ingredients of today's FinTech curriculum were taught as separate fields of studies under one program with different concentrations like programs having a business major with AI, Machine Learning, Blockchain, programming, etc., as elective courses.

FinTech 4.0 (2019 – to date) is the era of FinTech start-ups from developing and emerging countries. The rise of FinTech start-ups is mainly due to the increasing number of regulations and the decline of public perception. In addition, the rise of trust in the public toward financial start-ups has caused banks to become more cautious in their approach toward dealing with customers. Therefore, the emergence of FinTech start-ups in developing markets has been mainly influenced by the pursuit of achieving economic goals and becoming the last mover advantage after the transition.

The third world is a greenfield project that's focused on developing financial services for unfeasible consumers. This is because most individuals are ineligible to receive traditional financial services (Setiawan, & Maulisa, 2020). During this period, universities started offering FinTech programs as a single integrated curriculum like programs having FinTech as central with AI, Machine Learning, Blockchain, programming, etc., as core courses (Table 1).

Table 1. Evolution of FinTech Curriculum

Generation	FinTech 1.0	FinTech 2.0	FinTech 3.0	FinTech 4.0
Years	1866-1966	1967-2007	2008-2018	2019-todate
Penetration	<ul style="list-style-type: none"> Global & developed countries 	<ul style="list-style-type: none"> Global & developed countries 	<ul style="list-style-type: none"> Global & developed countries 	<ul style="list-style-type: none"> Emerging & developing countries
Objectives	<ul style="list-style-type: none"> Information Technology, Finance, and Banking evolved separately but had a handshake 	<ul style="list-style-type: none"> Use of information technology in traditional financial institutions to improve the quality of products or services. 	<ul style="list-style-type: none"> Use of technology by new entrants to provide non-intermediary services directly to customers 	<ul style="list-style-type: none"> The new competitive environment for financial institutions to offer products and services as a result of the fusion of technologies
Characteristics	<ul style="list-style-type: none"> Analog Banking Infrastructure development Usage of Telegraph & Telephone in Finance & Banking Computerization 	<ul style="list-style-type: none"> Electronic Banking Digitalization Traditional Internet Payment Gateways ATMs Online Banking Paypal 	<ul style="list-style-type: none"> Digital Banking Mobile/Smart Phone Banking Focus on Apps Hi-Tech Start-ups Distributive model of FinTech Digital Wallets Bitcoin Apply Pay/ Samsung Pay/ Google Pay 	<ul style="list-style-type: none"> Mobile Banking Fourth industrial revolution or Industry 4.0 Digital Transformation Agglomeration model of FinTech
Education / Curriculum **	<ul style="list-style-type: none"> Separate fields of study 	<ul style="list-style-type: none"> Programs having a business major with MIS or Information technology as a minor 	<ul style="list-style-type: none"> Programs have a business major with AI, Machine Learning, Blockchain, programming, etc., as elective courses. 	<ul style="list-style-type: none"> Programs have FinTech as central with AI, Machine Learning, Blockchain, programming, etc., as core courses.

Sources: (Bouaziz, & Sghari, 2021; Setiawan, & Maulisa, 2020; Jiao, Shahid, Mirza, & Tan, 2021). ** Observations by authors

FinTech, or technology-based solutions that disrupt and strengthen the financial services industry, has become one of the most promising sectors in the tech industry (Kursh, & Gold, 2016). Technology, Finance, and Management are often combined in order to improve the efficiency and profitability of financial services. This intersection of disciplines made financial services more accessible and less costly (Sung, Leong, Sironi, O'Reilly, & McMillan, 2019). The new FinTech sector is often considered disruptive due to its potential to improve the efficiency and profitability of financial institutions (Karkkainen, Panos, Broby, & Bracciali, 2017). Additionally growth in venture capital and credit markets also affected the growth of FinTech entrepreneurship (Kolokas, Vanacker, Veredas, & Zahra, 2020).

According to industry experts, the lack of skilled professionals has raised concerns about the profitability of FinTech start-ups (Karkkainen, et al., 2017). It is expected that mobile FinTech payment services will develop into more secure services in the future (Kang, 2018) and this area is still facing shortage of trained work force. There are shortages in both the finance and business fields for graduates from various social sciences and computer science disciplines. Such shortages exist for graduates from both the social sciences, such as finance and business, and the computer science background as the FinTech industry neither requires a financial expert nor needs hardcore programmers. Instead of just focusing on academics, they should also consider careers in finance, technology, or data analytics. Moreover, it often leads to new business models or even new start-ups (Leong, & Sung, 2018). The rapid emergence of FinTech has created new opportunities for business schools to develop new methods and solutions. The new skills requirements must be planned and are expected to be delivered through an integrated delivery model. This includes the necessary technical skills in programming, data analysis, and the development of applications (Karkkainen, et al., 2017).

3. Research objective and methodology

The objective of the current study was to develop a robust, validated customized curriculum structure for FinTech studies. All postgraduate qualifications on FinTech were searched. The initial search was filtered, and all distance learning institutions and online-only institutions were removed from the shortlisted list of institutions. At the second round of data screening, all the other degrees offering a minor in FinTech were removed. Many business schools offering FinTech as a course or significant in their MBA programs were also removed from shortlisted institutions. For example, New York Stern offers MBA FinTech, but the curriculum structure is based on the Global MBA curriculum and does not match the study's objectives. Finally, a list of 22 institutions offering MSc/MS degrees in FinTech was finalized (Table 2).

Table 2. List of Institutions offering MSc FinTech programs

No.	Degree Title	Institution Name	Country
1	MS Finance (FinTech and Financial Analytics)	HK Baptist University	Hong Kong
2	MS Financial Technology	New Jersey City University	USA
3	MSc Financial Technology	HK University of Science & Technology	Hong Kong
4	MSc Financial Technology	Imperial College Business School	UK
5	MSc Financial Technology	University of Birmingham	UK
6	MSc Financial Technology	University of Essex	UK
7	MSc Financial Technology	University of Glasgow	UK
8	MSc Financial Technology	University of Liverpool	UK
9	MSc Financial Technology	University of Strathclyde	UK
10	MSc Financial Technology (FinTech)	Nanyang Technological University	Singapore
11	MSc Financial Technology (FinTech)	Coventry University	UK
12	MSc Financial Technology (FinTech)	Manchester Metropolitan University	UK
13	MSc Financial Technology (FinTech)	Teesside University	UK

14	MSc Financial Technology (FinTech)	University of Salford	UK
15	MSc Financial Technology (FinTech)	University of Stirling	UK
16	MSc Financial Technology (FinTech)	University of Exeter	UK
17	MSc Financial Technology (FinTech)	University of West England - Bristol	UK
18	MSc FinTech, Risk and Investment Analysis	University of Sussex	UK
19	MSc FinTech with Business Analytics	University of Westminster	UK
20	MSc FinTech and Policy	University of Surrey	UK
21	MSc FinTech and Financial Markets	Nottingham Trent University	UK
22	MSc FinTech	University of Huddersfield	UK

In the second phase, courses were classified into broader subject areas and sub-subject areas (Table 2). Six subject areas were identified including (a) FinTech; (b) Technology; (c) Finance; (d) Analytics; (e) RegTech; and (f) Others.

4. Results and discussion

This research paper presents the findings on various methodological issues of curriculum design for a master's degree in FinTech, i.e., degree naming convention, major subject areas, degree structure, culmination point, dissertation versus project, specializations.

Major Subject Areas: A total of 249 courses (138 core courses and 111 electives) were classified into six subject areas (Table 2) including (a) FinTech; (b) Technology; (c) Finance; (d) Analytics; (e) RegTech; and (f) Others. Technology was again sub-divided into four distinct areas: information systems, Blockchain and Cryptocurrency, artificial intelligence and machine learning, and programming with R and Python. Similarly, finance was subdivided into three areas Corporate Finance, Investments, and Applied Finance. Analytics was subdivided into two areas quantitative and data analytics (Table 3).

Table 3. Identification of major/minor areas in FinTech Curriculum

Areas	Minor Areas	Core Courses	Elective Courses	Total
FinTech	FinTech	18	10	28
Technology	Programming	14	2	16
	Blockchain & Cryptocurrency	11	4	15
	Artificial Intelligence & Machine Learning	8	9	17
	Information Systems & Technology	7	10	17
Finance	Corporate Finance	18	8	26
	Investments	14	9	23
	Applied Finance	7	14	21
Analytics	Business & Data Analytics	16	10	26
	Quantitative Methods	5	7	12
RegTech	Regulatory Environment (RegTech)	7	4	11
Others	Entrepreneurship, Ethics & Risk	7	8	15
	Miscellaneous	6	16	22
Total		138	111	249

Pre-Masters Courses: As the nature of the degree is based on diversified disciplines, it is imperative to add pre-semester courses for students with academic deficiencies (Table 4).

Table 4. Semester Zero Courses / Pre-Masters Courses

Applicant's Deficiency	Course Title	Credit Hours
Finance	Introduction to Finance	3
AI & Machine Learning	Introduction to Information Systems	3
Programming	Introduction to Programming	3
Data Analytics	Introduction to Data Sciences	3
	Total	12

Degree Structure: An ideal postgraduate degree in FinTech must have at least 30 credit hours span over two semesters of course work, having four courses each semester and one project or dissertation in the third semester (Table 5).

Table 5. Sample study plan for Masters in FinTech

Semester	Subject Area	Course Title	Credit Hours
I	Finance & Banking	Corporate Finance	3
	FinTech	Financial Technology (FinTech)	3
	Programming	Programming in Python and R	3
	AI & Machine Learning	AI & Machine Learning	3
II	Blockchain & Cryptocurrency	Blockchain and Cryptocurrency	3
	FinTech-RegTech	RegTech	3
	Data & Business Analytics	FinTech Data Analytics	3
	Others	FinTech Strategies	3
III	FinTech Project	Project	6
Total			30

Degree Naming Convention: There are two primary degree naming conventions observed in MSc FinTech Curriculum. One is MSc Financial Technology, and the other one is MSc Financial Technology (FinTech). MSc FinTech was offered by 20 institutions, mainly from UK, Singapore, and Hong Kong, while two US business schools are offering MS FinTech. These degree nomenclature differences are inherent in two different countries, i.e., the US versus the UK. In addition, many institutions differentiated their offering with specializations evident from the degree title. For example, MSc FinTech, Risk and Investment Analysis (University of Sussex, UK); MSc FinTech with Business Analytics (University of Westminster, UK); and MSc FinTech and Policy (University of Surrey, UK). (See Figure 2).

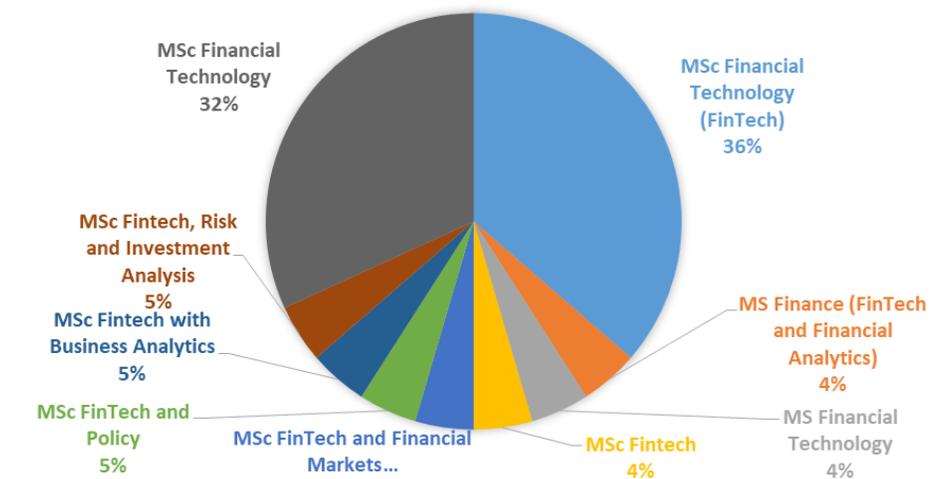


Figure 1. Distribution of Degree Naming Conventions for Master's degree in FinTech

Research: Usually, there are three options as a culmination point for a master's degree. Firstly, a semester-long project titled Applied Project, Final Project, or Research Project is equivalent to three-credit-hour courses.

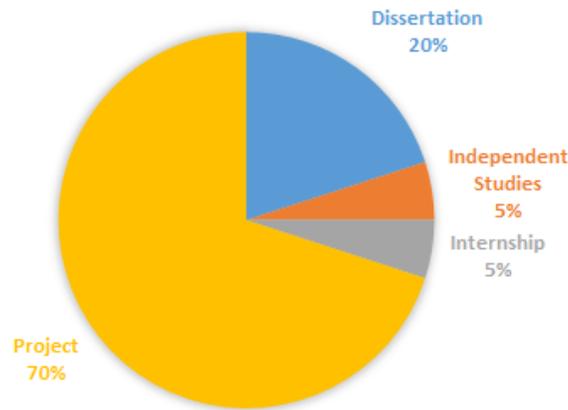


Figure 2. Research Component in FinTech Curriculum

Secondly, a semester-long internship, practicum, or work placement. They are also given equivalence to a 3-credit hour course. Sometimes grades are subject to the submission of a report. Thirdly, a semester-long dissertation on a relevant academic topic is closely supervised by senior research faculty members and often subject to available defense at the end. Commonly dissertations, sometimes called the thesis, are equivalent to 6-credit hour course work. There are merits and demerits of offering different options in a master's degree. Figure 2 presents the distribution of projects, internships, and dissertations in master's degree in FinTech. Further analyses show that 14% of universities offer all three options mentioned above, while 18% offer two methods and 68 % offer only one of the three options mentioned above. Additionally, 5% of universities do not offer any project, internship, or dissertation as part of degree requirements towards masters in FinTech, for example, Hong Kong University of Science & Technology.

5. Conclusion

FinTech could be considered the biggest revolution in the times to come, and it is becoming the most common manifestation of the latest phase of globalization in the modern age. The study explores how educational institutions and industry leaders are addressing the current FinTech curriculum problems. It also highlights the various opportunities for FinTech-related education and training in the region. The study focused on the various response strategies that were used to address the situation. The findings also reveal how educational institutions are addressing the needs of their students in terms of technical expertise. This paper also highlights how FinTech companies require skill enhancement programs for various industries. Various programs are aimed at cultivating local talent and boosting the financial industry's growth in the area. This theme focused on the various government and policy interventions to address the chronic skill shortage in FinTech. Due to the nature of the profession and the lack of sufficient peer-reviewed sources for this research, it is not easy to gauge the level of interest and response to the topic. However, this research also identifies various opportunities that could help develop the FinTech ecosystem. To validate these suggestions, various stakeholder groups should comprehensively assess the curriculum items related to FinTech.

6. Limitations

Researching on new and emerging topics is always tricky. It is difficult for even FinTech students and aspirants to evaluate the quality of FinTech qualifications. Moreover, people from different streams of education would like to join FinTech studies, and there is no standardization of professional association certifying FinTech curriculum, which has made the situation even worse.

7. Recommendations

This research provides numerous recommendations for universities, policymakers, and society in general. FinTech services can be classified into five broad categories: (a) payments, clearing, and settlement; (b) deposit, lending, and capital raising; (c) insurance; (d) investment management; and (e) market support. However, the FinTech curriculum offered by most of the universities covers one or two services only. However, this paper identifies the gaps in current FinTech education and suggests suitable remedies. Still, no single program covers all five categories in terms of courses, projects, or applications. This requires the development of new courses or amendments in existing courses to cover this gap. Business schools may find this opportunity to specialize their offering in one of the five broad categories mentioned above and position their brand image accordingly.

As universities worldwide begin to examine how they can prepare for the inevitable rise of FinTech, many are creating coursework to fill the skills gap. Unfortunately, this course does not go into depth about specific technologies, leaving students with limited job opportunities. To avoid teaching students the wrong version of FinTech, universities must constantly seek input from industry. Therefore, universities may need to take specific steps (such as improving collaboration and partnership with FinTech organizations) towards improving education curriculum to align more closely with the needs of FinTech employers. If possible, universities are advised to offer FinTech programs in collaboration with Cryptocurrencies exchanges and university business incubators so that graduates and society can get maximum benefits from the programs.

Master of Business Administration (MBA) programs have always been considered more in width and less in depth while other science, technology and engineering programs were always considered more in depth compared to the width of topics covered in those programs. The success of MBA programs was always attributed to their width. In other words, MBA programs offer courses in a wide range of subject areas like accounting, finance, management, marketing, operations, and supply chain information technology. Universities must learn to balance the vertical depth of FinTech programs versus the horizontal width of the FinTech programs. Similarly, business schools are hosting most of the FinTech programs. Considering the width of the subject areas offered in FinTech, it is advised to offer FinTech programs through multi-disciplinary teaching centers established in collaboration with computer science, information systems departments. Universities may also consider developing and promoting online education programs that provide an in-depth look at FinTech-related skills.

Lastly, the FinTech curriculum is still evolving, and there is no standardization available in academia in terms of the contents; neither any educational accreditation body has started giving accreditations to institutions offering FinTech programs or courses. Therefore, applying the standardization for FinTech curriculum development will provide confidence to existing FinTech professionals and provide a roadmap to FinTech aspirants.

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