

**Finance Disciplinary Task Force  
Phase III Report of the MaCuDE project<sup>1</sup>**

**Curriculum Recommendations for Finance  
Education in the Digital Era**

**Lara Kathcart  
Christopher Neill**

Finance Disciplinary Task Force Leaders  
Imperial College Business School  
London, UK

February 2023

---

<sup>1</sup> The MaCuDE project is sponsored by AACSB International and led by Stevens Institute of Technology.

# MaCuDe Project Phase 3 Finance Report

Prepared by  
Associate Professor Lara Cathcart  
Christopher Neill  
February 2023



# Contents

<b>1</b>	<b>Introduction</b>	<b>4</b>
<b>2</b>	<b>Skills by Roles</b>	<b>4</b>
2.1	2.1.1 Example Role-based Skills for Finance Graduates	5
2.2	2.2.1 Example Role-based Skills for MBA Graduates	6
<b>3</b>	<b>Curricular Initiatives to Deliver Skills for Digital Era</b>	<b>8</b>
3.1	Data Analytics and Machine Learning	9
3.11	Fundamentals of Data Analytics	9
3.12	Data Analytics and Machine Learning	9
3.13	Data Visualisation	10
3.2	Programming	11
3.21	Programming in R	11
3.22	Programming in Python	11
3.3	Algorithms and Artificial Intelligence	12
3.31	Algorithmic Trading Strategies	12
3.4	Emerging Digital Technologies	13
3.41	Introduction to Blockchain and Cryptocurrencies	13
3.42	Blockchain and Cryptocurrencies	14
3.5	Managing Digital Organisations	15
3.51	Ethics	15
3.52	Sustainable Investing (ESG)	15
3.6	Domain Specific Skills influenced by Digital Technology	17
3.61	Financial Technology	17
3.7	Domain-independent meta-skills	18
3.71	Leadership	18
3.72	Other meta-skills	19
3.8	Suggestions for delivery of course content	19
3.9	How could the courses be packaged?	20
<b>4</b>	<b>Maturity Levels for Curriculum Development</b>	<b>21</b>
4.1	Developing	21
4.2	Intermediate	21

---

4.3 Advanced	22
4.4 Staying Informed	22

---

# 1 Introduction

This report will analyse the skills required for the roles commonly sought by finance graduates, and the courses recommended to obtain them. Roles will be divided by degree type with different skills and goals for undergraduate, postgraduate and MBA programmes. In Phase 2, we reviewed the digital skills required by graduates for employment. The skillset can be wide ranging depending on the type of role the student is seeking within the financial services sector.

## 2 Skills by Roles

Tables 1 and 2 demonstrate examples of roles graduates would obtain on completion of their programmes from Undergraduate, Master's to MBA. Each role has skills listed by the themes identified in Phase 1; Data Analytics and Machine Learning; Programming; Algorithms and Artificial Intelligence; Emerging Digital Technologies; and Managing Digital Organisations.

There are a variety of different roles within the financial services sector. Roles vary in quantitative ability and digital skillset. Markets or Sales and Trading roles may be less quantitative in nature. Graduates with degrees or specialisms in Financial Engineering have the technical and quantitative background to seek quant positions or roles in the Financial Technology sector.

## 2.1 Example Role-based Skills for Finance Graduates

Table 1: Example Role-based Skills for Finance Graduates from Bachelor's and Master's programmes

Domain: Finance				
Education Level and Role/Function	Degree Requirement	Bachelor's	Master's	
	Example Role	<ul style="list-style-type: none"> <li>• Graduate Trainee</li> </ul>	<ul style="list-style-type: none"> <li>• Investment Banking Analyst</li> <li>• Markets Analyst</li> </ul>	<ul style="list-style-type: none"> <li>• Quantitative Analyst</li> <li>• Risk Management Analyst</li> <li>• FinTech Analyst</li> </ul>
	Role Description	A person with a strong interest in financial services who can perform basic analytical skills.	A person with strong knowledge of global markets and financial services. Someone who is analytical, a strong problem solver with excellent interpersonal and communication skills who can interact with clients and teams.	A person with strong mathematical and programming skills. Someone who is analytical, a strong problem solver with the ability to communicate technical concepts clearly with clients and teams.
Skills for Digital Era Themes	Data Analytics and Machine Learning	<ul style="list-style-type: none"> <li>• Fundamentals of Data Analytics</li> </ul>	<ul style="list-style-type: none"> <li>• Data Visualisation</li> </ul>	<ul style="list-style-type: none"> <li>• Data Analytics and Machine Learning for Finance</li> <li>• Data Visualisation</li> </ul>
	Programming	<ul style="list-style-type: none"> <li>• Programming</li> </ul>	<ul style="list-style-type: none"> <li>• Programming for Finance (R, Python)</li> </ul>	<ul style="list-style-type: none"> <li>• Programming for Finance (R, Python)</li> </ul>
	Algorithms and Artificial Intelligence			<ul style="list-style-type: none"> <li>• Algorithmic Trading Strategies</li> </ul>
	Emerging Digital Technologies		<ul style="list-style-type: none"> <li>• Introduction to Blockchain and Cryptocurrencies</li> </ul>	<ul style="list-style-type: none"> <li>• Blockchain and Cryptocurrencies</li> </ul>
	Managing Digital Organisations	<ul style="list-style-type: none"> <li>• Ethics</li> </ul>	<ul style="list-style-type: none"> <li>• Sustainable Investing (ESG)</li> <li>• Ethics</li> </ul>	<ul style="list-style-type: none"> <li>• Sustainable Investing (ESG)</li> <li>• Ethics</li> </ul>
Meta-Skills and Domain	Domain Specific Skills influenced by Digital Technology			<ul style="list-style-type: none"> <li>• Financial Technology</li> </ul>
	Domain-independent meta-skills	<ul style="list-style-type: none"> <li>• Communication</li> <li>• Teamwork</li> </ul>	<ul style="list-style-type: none"> <li>• Problem Solving</li> <li>• Communication</li> <li>• Presentation Skills</li> <li>• Teamwork</li> </ul>	<ul style="list-style-type: none"> <li>• Problem Solving</li> <li>• Communication</li> <li>• Presentation Skills</li> <li>• Teamwork</li> </ul>

## 2.2 Example Role-based Skills for MBA Graduates

Table 2: Example Role-based Skills for Finance Graduates from MBA programmes

Domain: Finance				
Education Level and Role/Function	Degree Requirement	MBA		
	Example Role	<ul style="list-style-type: none"> <li>Investment Banking Associate</li> <li>Sales and Trading Associate</li> </ul>	<ul style="list-style-type: none"> <li>Quantitative Associate</li> <li>FinTech Banking Associate</li> </ul>	<ul style="list-style-type: none"> <li>FinTech Business Development Manager</li> </ul>
	Role Description	A similar role to an analyst, with the ability to supervise and develop junior bankers. A liaison between senior and junior members of staff.	A similar role to an analyst, with the ability to supervise and develop junior bankers. A liaison between senior and junior members of staff.	A strategic role in a FinTech organisation, requiring an understanding of the sector and the ability to identify new opportunities for growth. Excellent leadership and problem solving skills with the ability to communicate and negotiate at senior levels.
Skills for Digital Era Themes	Data Analytics and Machine Learning	<ul style="list-style-type: none"> <li>Data Visualisation</li> </ul>	<ul style="list-style-type: none"> <li>Data Analytics and Machine Learning for Finance</li> <li>Data Visualisation</li> </ul>	<ul style="list-style-type: none"> <li>Data Analytics and Machine Learning for Finance</li> <li>Data Visualisation</li> </ul>
	Programming		<ul style="list-style-type: none"> <li>Programming for Finance (R, Python)</li> </ul>	
	Algorithms and Artificial Intelligence			
	Emerging Digital Technologies	<ul style="list-style-type: none"> <li>Introduction to Blockchain and Cryptocurrencies</li> </ul>	<ul style="list-style-type: none"> <li>Blockchain and Cryptocurrencies</li> </ul>	<ul style="list-style-type: none"> <li>Blockchain and Cryptocurrencies</li> </ul>
	Managing Digital Organisations	<ul style="list-style-type: none"> <li>Sustainable Investing (ESG)</li> <li>Ethics</li> </ul>	<ul style="list-style-type: none"> <li>Sustainable Investing (ESG)</li> <li>Ethics</li> </ul>	<ul style="list-style-type: none"> <li>Sustainable Investing (ESG)</li> <li>Ethics</li> </ul>
Meta-Skills and Domain	Domain Specific Skills influenced by Digital Technology		<ul style="list-style-type: none"> <li>Financial Technology</li> </ul>	<ul style="list-style-type: none"> <li>Financial Technology</li> </ul>
	Domain-independent meta-skills	<ul style="list-style-type: none"> <li>Leadership</li> <li>Problem Solving</li> <li>Communication</li> <li>Presentation Skills</li> <li>Teamwork</li> </ul>	<ul style="list-style-type: none"> <li>Leadership</li> <li>Problem Solving</li> <li>Communication</li> <li>Presentation Skills</li> <li>Teamwork</li> </ul>	<ul style="list-style-type: none"> <li>Leadership</li> <li>Problem Solving</li> <li>Communication</li> <li>Presentation Skills</li> <li>Teamwork</li> </ul>

## Considerations for Recruitment to Finance Programmes

It is possible to recruit to the finance sector straight from undergraduate programmes, although most organisations require a masters level qualification for analyst positions. Masters level often provides graduates with a deeper technical skillset.

Students studying MBA programmes do so to progress their careers with leadership, but it can also be seen by the finance sector as a career change qualification. MBA graduates may also go into analyst roles or roles at the associate level as they graduate with stronger leadership skills. Some may go into more senior management positions but have likely spent time in the financial services sector beforehand.

Quantitative and technological roles can be recruited straight from UG from computing programmes; however, stronger candidates may choose to study an MSc to strengthen their Finance knowledge.

### 3 Curricular Initiatives to Deliver Skills for Digital Era

As discovered in Phase 1, Finance programmes at all levels, UG, Master’s and MBA, have core theoretical modules in both corporate finance and investment management. These courses are still relevant for students to develop a grounding understanding of the subject, with crucial knowledge and skills.

Finance programmes		
Core Modules		
Corporate Finance	Investment Management	Programming
Accounting	Ethics	Empirical Finance

For financial engineering programmes, we have assumed prerequisite theoretical knowledge will be obtained in additional core modules teaching mathematics for finance, derivatives, data analytics and econometric theory.

Financial Engineering			
Core Modules			
Financial Engineering	Investment Management	Programming	Mathematics for Finance
Econometrics/Financial Statistics	Derivatives	Ethics	Data Analytics

We analysed the skills required for roles within the finance sector within Phase 2 through surveys and conversations with professionals from the financial services industry. From this, we have compiled a list of recommended courses to identify how the skills can be obtained through the programmes:

- Fundamentals of Data Analytics
- Data Analytics and Machine Learning
- Data Visualisation
- Programming in R
- Programming in Python
- Algorithmic Trading Strategies
- Introduction to Blockchain and Cryptocurrencies
- Blockchain and Cryptocurrencies
- Ethics
- Sustainable Investing (ESG)
- Financial Technology

Generalist finance programmes may wish to utilise these courses within core curriculums, electives or pathways. Financial Engineering programmes developing proficiency in digital skills may wish to embed them as part of their core curriculum.

For each course, we’ve highlighted an example of the skills students will gain at completion and recommendations for teaching. We’ve also provided examples of how a course may wish to be structured session by session. Some courses have suggestions for advanced, specialised, and experiential sessions.

## 3.1 Data Analytics and Machine Learning

### 3.11 Fundamentals of Data Analytics

#### *Example of a Course Outline*

This introductory course will teach students the fundamental skills and methods for data analysis. Students will learn through the practical application of skills to actual problems from the financial sector. The goal of this course is that students will be able to understand the key concepts and methods of data analytics when presented with completed analytics and to do their own analysis.

#### *Skills Gained:*

By the end of the course, students will be able to:

- Describe the importance of data analysis and its practical applications for their future in finance
- Demonstrate an understanding of how data analysis works to create solutions for real problems in the finance sector

#### *Recommendations for teaching Fundamentals of Data Analytics*

Data Analytics and Machine Learning courses will benefit from students having a foundation knowledge and understanding of statistics and mathematics.

Taught sessions can include:

- An overview of the field of data analytics and applications to the finance sector
- Data processing and cleaning data
- Converting, cleaning and structuring data
- Exploring, summarising and visualising data with tools including Tableau and Excel
- An overview of governance and ethics relating to Data Analytics within Finance

More advanced skills can be built with further sessions on:

- Visualising data with Excel, Python or R
- An introduction to data modelling techniques

### 3.12 Data Analytics and Machine Learning for Finance

#### *Example of a Course Outline*

This course will teach students the fundamentals of data analytics and machine learning with an emphasis on how these tools are used in the real-world financial sector. This course will start by teaching students about large structured and unstructured datasets and general data analytics. Students will then learn the basics of machine learning, including data cleaning, pre-processing, model selection (classification vs regression), and training. Students will learn how to ensure accuracy in their predictions and for quantitative portfolio construction. Students will then apply these techniques to a range of markets using financial datasets.

#### *Skills gained*

By the end of the course, students will be able to:

- Explain and operate simple models to predict defaults in various markets
- Evaluate and use multiple quantitative techniques to construct a comprehensive strategy for trading
- Create models to predict default in corporate and retail credit markets using a range of data analytics and machine learning

## *Recommendations for teaching Data Analytics*

With most Data Analytics and Machine Learning courses, students will need a prerequisite understanding of mathematics, statistics, and programming language. An advanced Machine Learning course could be offered to students in Financial Engineering programmes to further develop this skill.

Sessions can include:

- As an overview of the field of data analytics in finance and its applications, including data collection, cleaning, and visualisation
- Statistical analysis of financial data, including descriptive statistics, probability distributions, and hypothesis testing
- Data modelling in finance, including linear and nonlinear regression, decision trees, and machine learning practices
- Analysing and forecasting time series data
- Using data analytics to manage financial risk methods
- Data analytics for big data and algorithmic trading

Advanced or specialised courses may wish to include further sessions on:

- Processing real-time data and using advanced algorithms and AI strategies
- Natural language processing for unstructured financial data sets and Advanced financial modelling
- Deep learning techniques with finance applications

Case studies can be used for students to apply theories and practices to real-world data sets. Specialised programmes may also wish to include small or large research projects where students can solve problems using data analytics.

### **3.13 Data Visualisation**

#### *Example of a course outline*

This course will teach students the fundamentals of data visualisation, drawing on methods from science, math, and technology. Students will first learn theories of design and perception and their application to data visualisation in the financial sector. Students will then gain the critical thinking skills necessary to evaluate and make the best decisions for data visualisations. They will develop an understanding of design concepts like colour theory and UI design. Finally, they will learn various relevant data visualisation methods and libraries used in the contemporary financial sector.

#### *Skills gained*

By the end of this course, students will be able to:

- Understand and select the right data visualisation technique for a range of circumstances
- Produce data visualisation using various systems and libraries, including Tableau, Matplotlib, Ggplot, and Altair

#### *Recommendations for teaching Data Visualisation*

Data Visualisation can be a stand-alone course or one that can be combined with a Data Analytics course. In Phase 2, graduates described the need to learn how to familiarise themselves with visualisation software (such as Tableau) quickly, as the need to present data to clients is essential.

Sessions can include:

- The foundations of data visualisation including of visual perception, design and colour theory

- An introduction to data visualisation tools such as Tableau, Python, R and Excel
- Cleaning and preparing data for visualisation
- Different chart types and encoding data
- How to tell a story using visualisation techniques

Advanced or specialised courses may wish to include further sessions on:

- Interactive visualisation
- Visualising big data sets
- Network visualisation techniques

Courses can use real-world data sets and can be taught through case studies. Course leaders may choose to assess with simulations where students are asked to present real-world data using visualisation theory and skills developed within the course.

## 3.2 Programming for Finance

### 3.21 Programming in R

#### *Example of a Course Outline*

This course will teach students the fundamentals of programming in R. Students will learn the basics of programming in R, data visualisation options with R, process-oriented programming, and finally, data analysis in R. Students will learn all these skills while using data and examples relevant to the financial sector. This course is meant for students with little to no programming experience and will provide a solid foundation in programming for the rest of their education and careers.

#### *Skills gained*

By the end of this course, students will be able to:

- Present advanced plots and other types of data visualisation using Ggplot
- Complete quantitative and multi-variate analysis of financial data using R

### 3.22 Programming in Python

#### *Example of a Course Outline*

This course will teach students the basics of programming in Python. Students will learn the fundamentals of programming in Python, including operators, variables, types, conditions, loops, functions, collections, file operations, exceptions, classes and object-oriented programming, the Python standard library. Students will apply knowledge to examples and problems using data relevant to the financial sector. This course is meant for students with little to no programming experience and will provide a solid foundation in programming for the rest of their education and careers.

#### *Skills gained*

By the end of this course, students will be able to:

- Present advanced plots and other types of data visualisation using Matplotlib
- Complete quantitative and multi-variate analysis of financial data using Python

#### *Recommendations for teaching Programming*

Students should familiarise themselves with programming language through workshops, tutorials and, most importantly, hands-on programming exercises. An introductory course will be able to introduce basic programming concepts and give the opportunity to practice and refine their understanding of the key concepts within their exercises. Workshops, either in person or online, can be beneficial for students to practice their programming skills with the support of a tutor. The course could provide an individual project for students to complete to

assess their understanding and knowledge of the key concepts of their programming language.

Programming is a skill that requires development over time. Programming can be introduced at the start of the programme as a skill to be built upon within further study. Students will benefit from opportunities to further develop their programming skills by working on further coursework and projects within other finance modules.

From Phase 2, we noted most organisations were leaning towards Python as the leading programming language used within the sector. Schools offering more quantitative and computational programmes, like Financial Engineering, may wish to invest in Python courses. Phase 2 demonstrated corporate finance roles within the sector require students only to have a basic understanding of a programming language but not necessarily a working knowledge. R is a more simplified language and can be offered on programmes developing less quantitative finance skills.

There are also many online tools, such as [Data Camp](#), which are free for students to use. Schools can utilise these to support students learning.

## 3.3 Algorithms and Artificial Intelligence

### 3.31 Algorithmic Trading Strategies

#### *Example of a Course Outline*

This course will teach students about algorithmic trading strategies. Students will learn a large range of strategies used across various asset and firm types, including but not limited to: Mean reversion, Arbitrage, and Market Timing. Students will learn practical applications of these strategies using Python with an emphasis on back-testing of carry, momentum and value strategies. Students will have to prove their learning by using real problems from hedge funds and banks. The aim of this course is to provide an introduction to the wide range of algorithmic trading strategies and their application in portfolio management.

#### *Skills Gained*

By the end of the course, students will be able to:

- Choose and justify algorithmic trading strategies over a range of asset classes with a mind to risk management
- Use Python to perform back-testing strategies and to quantitatively analyse the performance of other algorithmic trading strategies
- Create live applications of algorithmic trading strategies and other financial models using a wide variety of python tools, hedge funds and bank simulations

#### *Recommendations for teaching Algorithmic Trading*

Students will need prerequisite quantitative and statistical knowledge of finance in addition to programming language skills and core modules in econometric theory to learn practical trading skills in an applied course. Courses could be taught by practitioners in the field with a focus on skill development.

Sessions can include:

- An overview of Algorithmic Trading, its history, and its current use within the finance industry
- Techniques for collecting and organising data for algorithmic trading
- Quantitative trading strategies, including linear factor models, priced factors and momentum strategies
- The basics of hedge funds and global macro hedge funds

- High-frequency trading strategies
- Methods for portfolio optimisation
- Risk management and modelling
- Laws and regulations within algorithmic trading

Advanced or specialised courses may wish to include further sessions on:

- Using Machine learning and AI techniques, neural networks and support vector machines
- Reinforcement learning techniques to design and implement trading strategies

Algorithmic Trading would be a valuable asset to teaching within Financial Engineering programmes. The content may be more suited to skills developed at the MS level as opposed to undergraduate. There would be value in introducing key concepts in Econometrics modules at undergraduate. Recruiters are more likely to look to MS programmes for specialised skill sets in this area.

An interactive teaching method could be a simulation activity such as a trading game or back-testing project drawing on and developing a student's trading strategy skills and programming. Proficiency in this field can be further developed through a research project partnered or an applied piece of work partnered with an internship.

## 3.4 Emerging Digital Technologies

### 3.41 Introduction to Blockchain and Cryptocurrencies

#### *Example of a Course Outline*

This introductory course will teach students about the fundamentals of blockchain technology and its application in the financial sector. Students will learn about the types of distributed ledgers based on their data structures, consensus types (proof of work vs stake), and permission structures. By the end of the module, students will be able to explain blockchain technology and the impact it is having on existing markets.

#### *Skills gained*

By the of the course, students will be able to:

- Explain the revolutionary power of blockchain technology
- Identify and assess the current problems with blockchain technology and the solutions currently being explored
- Describe new trends in blockchain technologies, including but not limited to Cryptocurrency, Blockchain, Smart Contracts, Peer-to-Peer Lending, Crowdfunding, ICO, DeFi, NFT, and Central Bank Digital Currencies
- Appraise the response of firms' business models to emerging blockchain technologies

#### *Recommendations for teaching Introduction to Blockchain and Cryptocurrencies*

Sessions can include:

- An overview of blockchain technology, its history and current uses within the financial services sector
- An introduction to distributed ledger platforms such as Ethereum and Verus
- An introduction to smart contracts
- An overview of decentralised finance (DeFi) and applications run on blockchain platforms
- Cryptocurrencies and trends within blockchain technology
- Case studies on firms using blockchain

### 3.42 Blockchain and Cryptocurrencies

#### *Example of a Course Outline*

This course will teach students the essential knowledge of blockchain technologies such as cryptography, consensus protocols, and peer-to-peer networking using cryptocurrency. Students will learn about the types of distributed ledgers based on their data structures, consensus types (proof of work vs stake), and permission structures. Students will benefit from applied teaching on how to operate smart contracts and logic on a public blockchain. Students will also learn about the current landscape of blockchain platforms and interpret the different uses for each platform.

#### *Skills gained*

By the end of the course, students will be able to:

- Understand and compare current distributed ledger and blockchain platforms
- Operate simple logic procedures on a public ledger
- Examine the role of distributed ledger technologies on firms and critically assess
- Understand and appraise the regulator and legal challenges inherent to blockchain technologies

#### *Recommendations for teaching Blockchain and Cryptocurrencies*

Courses in blockchain can begin with an overview of the history, development and impact of Blockchain technology within the financial services industry. This is beneficial for Finance programmes at MS and MBA levels. Students will require a prerequisite understanding of the financial services sector gained from core module teaching.

Sessions can include:

- An overview of blockchain technology, its history and current uses within the financial services sector
- Distributed ledger platforms and a deep look into
- How to design and employ smart contracts on platforms like Ethereum
- Cryptocurrencies, the current state of how digital currencies are used in the market
- Laws and regulation of cryptocurrencies and crypto assets
- Critically assessing case studies on businesses utilising blockchain technology

Advanced or specialised courses may wish to include further sessions on:

- Supply chain management and how blockchain is being used to improve transparency
- IoT systems and how blockchain technology can be used to enhance security

For MS Financial Engineering programmes, a more practical applied approach is needed, where students engage and work with distributed ledger platforms. Students will require a quantitative background and programming experience, and sessions will likely be comprised of lectures and practical coding sessions.

## 3.5 Managing Digital Organisations

### 3.51 Ethics

#### *Example of a Course Outline*

In this course, students will review the key factors and responsibilities for ethical practice in finance. This course aims to introduce students to corporate responsibility and professional standards for financial analysts and associates. The course can use the CFA standards to ensure industry standards on ethics are covered. CFA standards are illustrated through real-life examples, cases and quizzes. Sessions can be complemented with examples from practitioners in the field who will talk about their experience and provide background on each of the standards.

#### *Skills Gained*

Students will gain an understanding of the following CFA standards:

- Professionalism – knowledge of the law; independence and objectivity; misrepresentation, and misconduct
- Integrity of capital markets - material non-public information; and market manipulation
- Duties to clients - loyalty, prudence and care; fair dealing; suitability; performance presentation and preservation of confidentiality
- Duties to employers – loyalty; additional compensation arrangements; and responsibility of supervisors
- Investment analysis - diligence and reasonable basis; communication with clients and prospective clients; record retention
- Conflicts of interest - disclosure of conflict; priority of transactions; referral fees

#### *Recommendations for teaching Ethics*

Ethics is a topic that will be touched upon in many finance courses at all levels. Schools may choose to embed the teaching of ethical standards within their compulsory modules where suitable or as a stand-alone course. The use of case studies will further cement student's understanding and provide thoughtful discussion.

### 3.52 Sustainable Investing (ESG)

#### *Example of a course outline*

This course will teach students the fundamentals of sustainable finance and impact investment. Students will learn about current trends in capital markets, institutional investment and emerging markets relating to sustainable investing. Students will gain an understanding of corporate environmental, social and governance (ESG) investment, impact investment and the 17 Sustainable Development Goals (SDGs). Students will learn about new movements such as transition finance, adaptation and resilience, net zero portfolio alignment and nature-based investing. Students will be able to articulate how these emerging strategies respond to investors' concerns about climate change and other SDGs. Students will also assess the various metrics used in impact investing and the regulations relating to these metrics.

#### *Skills Gained*

By the end of the course, students should be able to:

- Identify and summarise the current landscape for sustainable finance with an emphasis on ESG focused investment
- Use and explore the validity of a range of sustainability metrics and assessment approaches in various cases and simulations
- Describe the regulations and policies that relate to sustainable finance and how they currently affect the market

### *Recommendations for teaching Sustainable Investing*

Students will require prerequisite knowledge of corporate finance prior to learning sustainable finance. An applied focus on delivery incorporating case studies will support students in developing their skillset in this field. As this field is continuously evolving, Schools may wish to introduce guest speakers or relevant experts in the field for students to gain up-to-date practical knowledge.

Sessions can include:

- An overview of sustainable investing, including its history and current place within the financial services industry
- Frameworks used to evaluate the environmental, social, and governance performance of businesses
- Techniques for investing in businesses that have a positive social or environmental impact
- Measuring the risk of sustainable investments
- Ethics and governance of sustainable investing
- Sustainable investing regulations and policy, including initiatives to promote sustainable investing

Advanced or specialised courses may wish to include further sessions on:

- Investment strategies, including mutual funds and impact funds
- Applying the concepts and techniques covered in the module to a real-world case study

## 3.6 Domain Specific Skills influenced by Digital Technology

### 3.6.1 Financial Technology

*Example of a course outline:*

This course will teach students about the emerging industry of FinTech. Students will learn about Fintech companies through a case study approach. This helps students understand the innovation, disruption, and strategies used by successful FinTech companies in various industries, such as financial apps and open banking, cryptocurrencies and other blockchain technologies, and cyber-security. Students will also gain an understanding of the regulatory environment faced by each company and how they navigated their relationships with different stakeholder groups.

*Skills Gained:*

By the end of this course, students will be able to:

- Define the current landscape for emerging FinTech firms
- Assess and compare traditional business strategies and FinTech
- Devise the best governance structure for a FinTech company, including intra- and inter-organisational governance
- Appraise opportunities for new technology adoption

*Recommendations for teaching Financial Technology:*

A prior understanding of the financial services sector is recommended.

Sessions can include:

- An introduction to FinTech and its history and disruption to the financial services industry
- The use of cryptocurrencies and blockchain
- Cloud computing, microservices and distributed ledger technology
- Deconstructed Finance (DeFi)
- New methods of banking, including digital payment systems, lending and crowdfunding
- FinTech business models and case studies
- Financial regulation of banks and FinTech businesses

Advanced or specialised courses may wish to include further sessions on:

- The function of artificial intelligence and machine learning within the FinTech landscape
- Cybersecurity and fraud detection

Financial Technology is best explored through case studies which allow students to engage with various concepts, frameworks, and tools in a practical, real-world setting.

A course overview of the FinTech sector does not necessarily require further programming or digital skill prerequisites. A standard course could provide students with the knowledge and ability to critically evaluate a FinTech business.

An advanced course could include a project where students can propose a solution to a Financial Technology problem in the real world, building on data analytics, programming and machine learning skills. There are also opportunities for students to partner with local or international FinTech businesses for group projects or challenges.

## 3.7 Domain-independent meta-skills

Phase 2 demonstrated a need for meta-skills within the finance sector. These skills were considered equally necessary for all finance roles. Schools may wish to embed these skills within the overall learning objectives of a programme as opposed to specific courses.

### 3.71 Leadership

More commonly found in MBA programmes, a specific course can cover all the fundamentals of leadership, ethical behaviour and decision-making, as well as diversity within organisations and a broader look at business and society. Students will gain abilities to motivate, inspire, and drive positive change on multiple levels.

#### *Skills Gained:*

By the end of this course, students will be able to:

- Analyse the impact of leadership on organisational culture
- Appreciate the cross-cultural principles used to inform ethical decisions
- Evaluate the effectiveness of leadership in different situations
- Develop a personal leadership action plan
- Design a leadership plan for an organisation or business

#### *Recommendations for teaching Leadership:*

Leadership can be taught as a stand-alone course or embedded within a student's journey throughout the programme.

Sessions can include:

- Theories of leadership and the different leadership styles
- Self-awareness, emotional intelligence and managing unconscious bias
- Effective communication, active listening and managing conflict
- Leading and building effective teams and businesses
- Strategic thinking, problem-solving and decision making
- Working in diverse organisations
- Ethical leadership and integrity

A project or report can be undertaken in conjunction with an internship or work placement where a student can reflect on leadership in practice and critically analyse their own performance or that of a business or organisation.

### 3.72 Other meta-skills

#### *Communication and Presentations*

Students will spend time developing an understanding of communication and how to come across effectively. Throughout the programme, they will be required to communicate with fellow students, complete coursework and negotiate their way around work priorities. Written reports allow for the development of written communication and helps learn how to get messages across effectively. Courses can provide students with the opportunity to develop a range of communication skills, from oral presentations to networking effectively. Students will develop communication skills to enable them to communicate effectively within the workplace and at interviews.

#### *Teamwork*

Students will need to work on group-based projects, tasks and presentations to develop teamwork skills. Coursework tasks can be applied to most courses where one of the learning objectives could be to work effectively as a team. Students can learn how to reflect on how well they've worked and apply this to future projects.

### *Problem-Solving*

Students can develop strong problem-solving skills through coursework, projects and workshops. Many of the recommended digital skills can be utilised to solve complex financial problems. For example, Data Analytics, Machine Learning and Programming are tools in which students can apply critical thinking to a project.

## **3.8 Suggestions for delivery of course content**

### *Applied Teaching*

Skill development is enhanced by an applied teaching approach. Students learn by engaging in the direct application of financial digital skills by being taught by an industry practitioner and using real world case studies. Guest speakers providing up-to-date examples from industry can complement courses enabling Schools to keep materials up-to-date and relevant.

### *Workshops*

Practical workshops in digital skills may be offered throughout the course. Workshops are particularly relevant to develop skills in programming, algorithmic trading, blockchain technology, and data analytics. Schools may wish to buy these in from third parties as exercises to complement core teaching. Workshops may also be used to develop meta-skills such as presenting and working as a productive team.

### *Projects*

Schools may wish to include a final project designed with an applied practical focus to the finance industry. Students can utilise skills developed throughout their programme and apply them to a real-life scenario as an analyst. For example, writing and documenting new software for a financial application. There is potential to link this to an internship or work placement, or where a School already has a partnership with a company. These links could provide students with the opportunity to resolve a real work issue that is directly linked to the sector.

### *Software*

Schools may wish to invest in data software facilities for students to work on real time data within a computer laboratory or suite.

Examples of recommended data software:

### *Bloomberg*

Bloomberg is the main source of real-time data for traders and asset managers in the world's leading financial organisations. Bloomberg provides very detailed information on a range of cash equities and bonds as well as derivatives. The historical range of data is limited, but data services such as Datastream are a good complement for this purpose.

### *Reuters Eikon*

Reuters Eikon is similar to Bloomberg in that it provides real-time data for a very large number of cash securities and derivatives. Imperial College Business School provides a small number of licenses for students that require this service. Reuters Eikon is particularly comprehensive in the area of foreign exchange data but contains very useful information on all other asset classes as well as inclined bonds, equities and commodities

### *Datastream*

Datastream is one of the best sources for long-term historical data for cash securities and derivatives as well as detailed company information. It contains longer time-series than many of the real-time data services.

### 3.9 How could the courses be packaged?

Phase One of the project showed us many Schools package their courses in a variety of ways. One popular method is concentrations and pathways. Given the variety of different roles within the finance sector, this method allows students to specialise based on their career aspirations.

For undergraduate and master's generalist finance programmes, Schools may choose to offer a financial engineering pathway where elective courses building a more technical skillset are chosen by students. This option may allow students to be exposed to the topics on offer before selecting their pathway. Alternatively, Schools may wish to run a separate financial engineering programme for students who are aware of their career aspirations from the beginning.

For MBA programmes, a specialist pathway is often chosen by students to develop their skills in their field of business. Many Schools choose to offer a finance pathway. Some schools may choose to run the emerging Tech MBA, as seen in Phase 1, where skills including programming, data analytics and data visualisation can be taught to cover a range of themes in their core learning with a specialised financial engineering pathway built in.

**Table 3 – An example of a course structure for a generalist finance programme offering a Financial Engineering pathway**

<b>Finance</b>				
<b>Core Modules</b>				
Corporate Finance	Investment Management	Programming	Accounting	Ethics
<b>Pathway Option for Financial Engineering</b>				
Mathematics for Finance/Derivatives/Financial Engineering	Econometrics/Financial Statistics	Data Analytics and Machine Learning	Financial Technology	
<b>Electives (select from a suite of choices - not an exhaustive list)</b>				
Data Visualisation	Blockchain and Cryptocurrencies	Sustainable Investing	Algorithmic Trading Strategies	

## 4 Maturity Levels for Curriculum Development

Recognising that different Schools have different maturity levels when it comes to digital era themes, we have created a ranking of recommendations from what we'd consider a minimum standard of digital readiness amongst graduates of finance on a scale based on the maturity of digital programs.

Using the following scale, Schools may wish to start developing their teaching of digital skills. From A-H, we have ranked the skills from a Developing to Advanced programme.

### 4.1 Developing

#### A. Programming

Programming is currently a sought-after skill. Phase 2 showed us it is the skill most in demand by the financial services sector. Experts in programming may earn a lot more outside of education so it can be challenging to find subject leaders in this area. For Schools that are unable to source internal Faculty to teach core programming skills, there are a variety of online sources like Data Camp which can provide the fundamentals of programming are delivered. Alternatively, Schools may wish to offer exchanges or credits with a partnering institution with a computer science focus. Students can then enhance this skill through projects and coursework throughout their programmes. Excel is the most commonly used software package from our Phase 2 focus groups. However, Python is becoming more popular to use. R is a strong substitute and is generally regarded as easier for students to grasp.

#### B. Data Analytics and Machine Learning for Finance

Finance professionals in all roles require skills in analysing data to make decisions based on their own calculations. We recommend Schools ensure Faculty are equipped with the necessary skill to deliver this content.

#### C. Ethics

Ethics can be taught as a stand-alone course or within other core learning subjects. The CFA provide a useful base to teach ethics within the financial services sector. Schools may wish to develop an online course and refer to any updates within the CFA standards to ensure the curriculum is up to date.

### 4.2 Intermediate

#### D. Data Visualisation

The ability to visualise and communicate data using software like Tableau was a popular discussion topic during Phase 2. Ensuring students have opportunities to use this software throughout their programmes enables them with digital skills they would need for analyst and associate roles. Schools can teach some aspects of visualisation within their programming courses with emphasis on ggplot and matplotlib for R and Python respectively. Schools may wish to invest in short workshops if the resource for a full course isn't viable.

#### E. Financial Technology

Financial Technology and an understanding of how the sector is being impacted by decentralised finance (DeFi) is important to support students with an understanding for roles that don't yet exist. Upskilling Faculty with knowledge in this area will be beneficial as it may become a field more prominent within the teaching of finance.

#### F. Sustainable Investing

As Phase 2 showed us, roles dedicated to ESG and measuring the risk of a company or investment due to their practices have become popular in recent years. Adding this content to the curriculum will ensure students are prepared for the future. Schools may wish to add portions of this content to core teaching if a full course isn't viable; perhaps with sourcing guest speakers or industry experts to engage with students on the subject. Student clubs in

this area are becoming increasingly common as younger generations have a passionate interest in sustainability.

### 4.3 Advanced

#### **G. Algorithmic Trading Strategies**

Algorithmic Trading is best taught in an applied format where students can develop critical thinking practice by solving real world problems. Courses can be taught by visiting practitioners or Faculty with significant experience in the sector. Trading workshops can run within the programme as an alternative to a full course. Schools may wish to invest in computer suites to simulate the experience of a real-world setting.

#### **H. Blockchain and Cryptocurrencies**

Blockchain can be taught as part of a basic Financial Technology course. Advanced applied practice can allow students to engage with distributed ledger technology. Schools may wish to upskill Faculty or bring in industry practitioners to deliver content.

### 4.4 Staying Informed

As with many sectors, the financial services industry is rapidly changing with the development of technology. To stay informed of the changes and the skills needed of graduates at all levels, Schools can periodically review their curriculum and course offerings. Alumni, particularly recent graduates, are crucial in informing Schools what skills have been most beneficial or what new skills they're needed to develop in their roles. Schools may also wish to seek advice from industry professionals at higher levels to inform the strategic direction of firms and start-ups. Inviting regular speakers into the School to listen to recent developments can also provide insight into timely developments in the digital era.