IAA on Financial Informatics

16/02/2024 – EPSRC IAA Funding Success Sharing Session

Dr. Javier Sanz-Cruzado & Dr. Richard McCreadie

Agenda

University of Glasgow
School of Computing Science

1. Financial Informatics at Glasgow
2. A timeline towards impact
3. Before IAA
4. During IAA
    1. PPC-FI
    2. FAR-Market
    3. FAR-AI
5. After IAA
6. Lessons learned and advice

Financial Informatics Research in Glasgow

University of Glasgow
School of Computing Science

Financial Informatics

- Financial Informatics is a research theme hosted by the Information, Data and Analysis section
  - It represents a cross-cutting group of researchers in Computing Science working on the research and development of AI and Information Retrieval technologies applied to financial use-cases and data

Dr. **Richard McCreadie** (Lead)

Real-time IR, Machine Learning, Big Data Stream Processing, Evaluation

Richard.McCreadie@glasgow.ac.uk

Professor **Iadh Ounis**

Information Retrieval, Data Science, Big Data Analytics, Sensing Systems

Iadh.Ounis@glasgow.ac.uk

Professor **Craig Macdonald**

Information Retrieval for Web, Enterprise, Social Media and Smart Cities

Craig.Macdonald@glasgow.ac.uk

Dr. **Javier Sanz-Cruzado**

Financial Recommendation Systems

javier.sanz-cruzadopuig@glasgow.ac.uk

We specialize in the development of sophisticated AI-powered services, which can collate, analyse and apply financial data in real-time

University of Glasgow
School of Computing Science

Three Research Pillars

Collate Diverse Information from Multiple Modalities

- **Market Data** — Capture how traders value assets over time an in different market conditions
- **Asset Fundamentals** — Know your business, track company performance, scale and growth
- **First Party Statements** — How does a business view itself and its prospects?
- **News and Social Media** — How does the world view the business and its products? What impact do world events have
- **Customer Data** — Know your customer via their transactions, investments and situation data

Analyse to Build Models, Data Structures and Gain Insights

- **Event Detection** — Identify financially relevant events, whether within-company or from the wider world
- **Technical Analysis** — Convert financial time series to human understandable KPIs
- **Knowledge Graphs** — Model financial facts and their relation ships, as well as how they evolve over time
- **Financial Language Models** — Build adapters for large language models, enabling them to better handle financial terminology
- **Content Categorization** — Develop AI models to classify and tag financial documents

Apply our technologies to tackle real financial use-cases

- **Asset Recommender** — Suggest suitable personalized investments for customers and advisors
- **Portfolio Construction** — Build optimized portfolios for investors
- **Robo-Advisors** — Answer financial questions and provide advice
- **Automatic Trading** — Automatically manage investment portfolios in real-time
- **Sustainability Optimization** — Optimize back-end financial data services to reduce carbon costs

How to turn research into Impact?

University of Glasgow
School of Computing Science

Passive Impact

A company reads one of your research papers and then implements some or all of it

…but how do you track it?

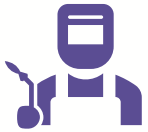
R&I Projects

Have a project with a company that can test your invention and maybe put it into production for you

Patents

Register a patent for an invention, companies can then pay a small fee to use your invention

Difficult to do for Computing Science, and the Uni budget for patents is small



Spin-out Company

Licence-Based: Create a piece of software or algorithm and then convince customers to pay a licence to use it

Product-Based: Create a real solution and market it to customers

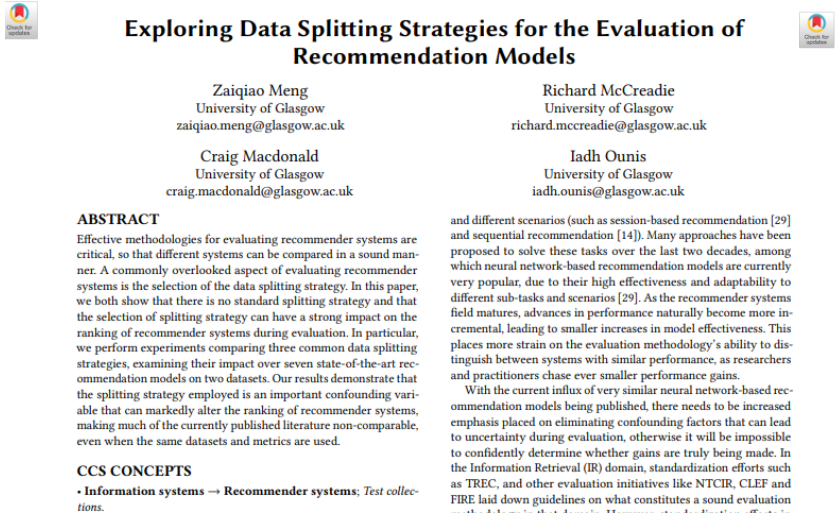
IAA can help us here!

Our Timeline Towards Impact

The Foundation

University of Glasgow
School of Computing Science

- Before any IAA journey, you need to start from the **core research**
  - We need to be expert in something before we can think about impact
- In our case this was experience in developing recommender systems
  - Movies, Groceries, Venues to Visit (we have done a lot of this over the last decade)
  - Get your early research published, you will need to demonstrate your expertise in an area



Exploring Data Splitting Strategies for the Evaluation of Recommendation Models

Zaiqiao Meng
University of Glasgow
zaiqiao.meng@glasgow.ac.uk

Richard McCreadie
University of Glasgow
richard.mccreadie@glasgow.ac.uk

Craig Macdonald
University of Glasgow
craig.macdonald@glasgow.ac.uk

Iadh Ounis
University of Glasgow
iadh.ounis@glasgow.ac.uk

ABSTRACT

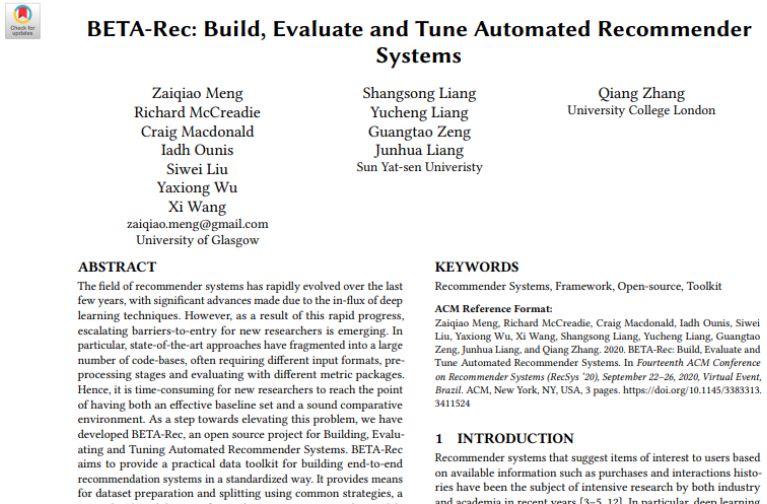
Effective methodologies for evaluating recommender systems are critical, so that different systems can be compared in a sound manner. A commonly overlooked aspect of evaluating recommender systems is the selection of the data splitting strategy. In this paper, we both show that there is no standard splitting strategy and that the selection of splitting strategy can have a strong impact on the ranking of recommender systems during evaluation. In particular, we perform experiments comparing three common data splitting strategies, examining their impact over seven state-of-the-art recommendation models on two datasets. Our results demonstrate that the splitting strategy employed is an important confounding variable that can markedly alter the ranking of recommender systems, making much of the currently published literature non-comparable, even when the same datasets and metrics are used.

CCS CONCEPTS

• **Information systems** → **Recommender systems**; *Test collections.*

and different scenarios (such as session-based recommendation [29] and sequential recommendation [14]). Many approaches have been proposed to solve these tasks over the last two decades, among which neural network-based recommendation models are currently very popular, due to their high effectiveness and adaptability to different sub-tasks and scenarios [29]. As the recommender systems field matures, advances in performance naturally become more incremental, leading to smaller increases in model effectiveness. This places more strain on the evaluation methodology's ability to distinguish between systems with similar performance, as researchers and practitioners chase ever smaller performance gains.

With the current influx of very similar neural network-based recommendation models being published, there needs to be increased emphasis placed on eliminating confounding factors that can lead to uncertainty during evaluation, otherwise it will be impossible to confidently determine whether gains are truly being made. In the Information Retrieval (IR) domain, standardization efforts such as TREC, and other evaluation initiatives like NTCIR, CLEF and FIRE laid down guidelines on what constitutes a sound evaluation



BETA-Rec: Build, Evaluate and Tune Automated Recommender Systems

Zaiqiao Meng
Richard McCreadie
Craig Macdonald
Iadh Ounis
Siwei Liu
Yaxiong Wu
Xi Wang
zaiqiao.meng@gmail.com
University of Glasgow

Shangsong Liang
Yucheng Liang
Guangtao Zeng
Junhua Liang
Sun Yat-sen Univeristy

Qiang Zhang
University College London

ABSTRACT

The field of recommender systems has rapidly evolved over the last few years, with significant advances made due to the in-flux of deep learning techniques. However, as a result of this rapid progress, escalating barriers-to-entry for new researchers is emerging. In particular, state-of-the-art approaches have fragmented into a large number of code-bases, often requiring different input formats, preprocessing stages and evaluating with different metric packages. Hence, it is time-consuming for new researchers to reach the point of having both an effective baseline set and a sound comparative environment. As a step towards elevating this problem, we have developed BETA-Rec, an open source project for Building, Evaluating and Tuning Automated Recommender Systems. BETA-Rec aims to provide a practical data toolkit for building end-to-end recommendation systems in a standardized way. It provides means for dataset preparation and splitting using common strategies, a

KEYWORDS

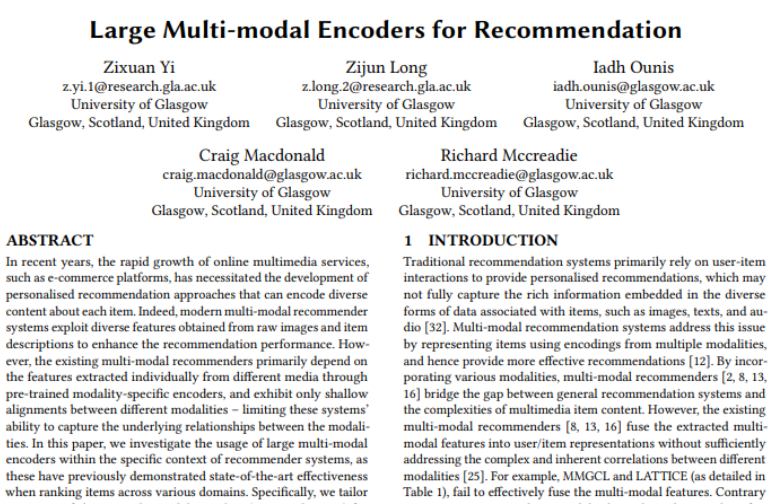
Recommender Systems, Framework, Open-source, Toolkit

ACM Reference Format:

Zaiqiao Meng, Richard McCreadie, Craig Macdonald, Iadh Ounis, Siwei Liu, Yaxiong Wu, Xi Wang, Shangsong Liang, Yucheng Liang, Guangtao Zeng, Junhua Liang, and Qiang Zhang. 2020. BETA-Rec: Build, Evaluate and Tune Automated Recommender Systems. In *Fourteenth ACM Conference on Recommender Systems (RecSys '20), September 22–26, 2020, Virtual Event, Brazil.* ACM, New York, NY, USA, 3 pages. https://doi.org/10.1145/3383313.3411524

1 INTRODUCTION

Recommender systems that suggest items of interest to users based on available information such as purchases and interactions histories have been the subject of intensive research by both industry and academia in recent years [3–5, 12]. In particular, deep learning



Large Multi-modal Encoders for Recommendation

Zixuan Yi
z.yi.1@research.gla.ac.uk
University of Glasgow
Glasgow, Scotland, United Kingdom

Zijun Long
z.long.2@research.gla.ac.uk
University of Glasgow
Glasgow, Scotland, United Kingdom

Iadh Ounis
iadh.ounis@glasgow.ac.uk
University of Glasgow
Glasgow, Scotland, United Kingdom

Craig Macdonald
craig.macdonald@glasgow.ac.uk
University of Glasgow
Glasgow, Scotland, United Kingdom

Richard Mccreadie
richard.mccreadie@glasgow.ac.uk
University of Glasgow
Glasgow, Scotland, United Kingdom

ABSTRACT

In recent years, the rapid growth of online multimedia services, such as e-commerce platforms, has necessitated the development of personalised recommendation approaches that can encode diverse content about each item. Indeed, modern multi-modal recommender systems exploit diverse features obtained from raw images and item descriptions to enhance the recommendation performance. However, the existing multi-modal recommenders primarily depend on the features extracted individually from different media through pre-trained modality-specific encoders, and exhibit only shallow alignments between different modalities – limiting these systems' ability to capture the underlying relationships between the modalities. In this paper, we investigate the usage of large multi-modal encoders within the specific context of recommender systems, as these have previously demonstrated state-of-the-art effectiveness when ranking items across various domains. Specifically, we tailor

1 INTRODUCTION

Traditional recommendation systems primarily rely on user-item interactions to provide personalised recommendations, which may not fully capture the rich information embedded in the diverse forms of data associated with items, such as images, texts, and audio [32]. Multi-modal recommendation systems address this issue by representing items using encodings from multiple modalities, and hence provide more effective recommendations [12]. By incorporating various modalities, multi-modal recommenders [2, 8, 13, 16] bridge the gap between general recommendation systems and the complexities of multimedia item content. However, the existing multi-modal recommenders [8, 13, 16] fuse the extracted multi-modal features into user/item representations without sufficiently addressing the complex and inherent correlations between different modalities [25]. For example, MMGCL and LATTICE (as detailed in Table 1), fail to effectively fuse the multi-modal features. Contrary

Timeline

University of Glasgow
School of Computing Science

Infinitech

October 2019

April 2023

Infinitech Project

University of Glasgow
School of Computing Science

- Based on our research profile, we were invited to an EU H2020 project
  - These are both research and innovation projects
  - Usually focused on taking expertise and applying it for target use-cases, but are pre-commercialization
  - Can act as a good starting point to move research towards innovation

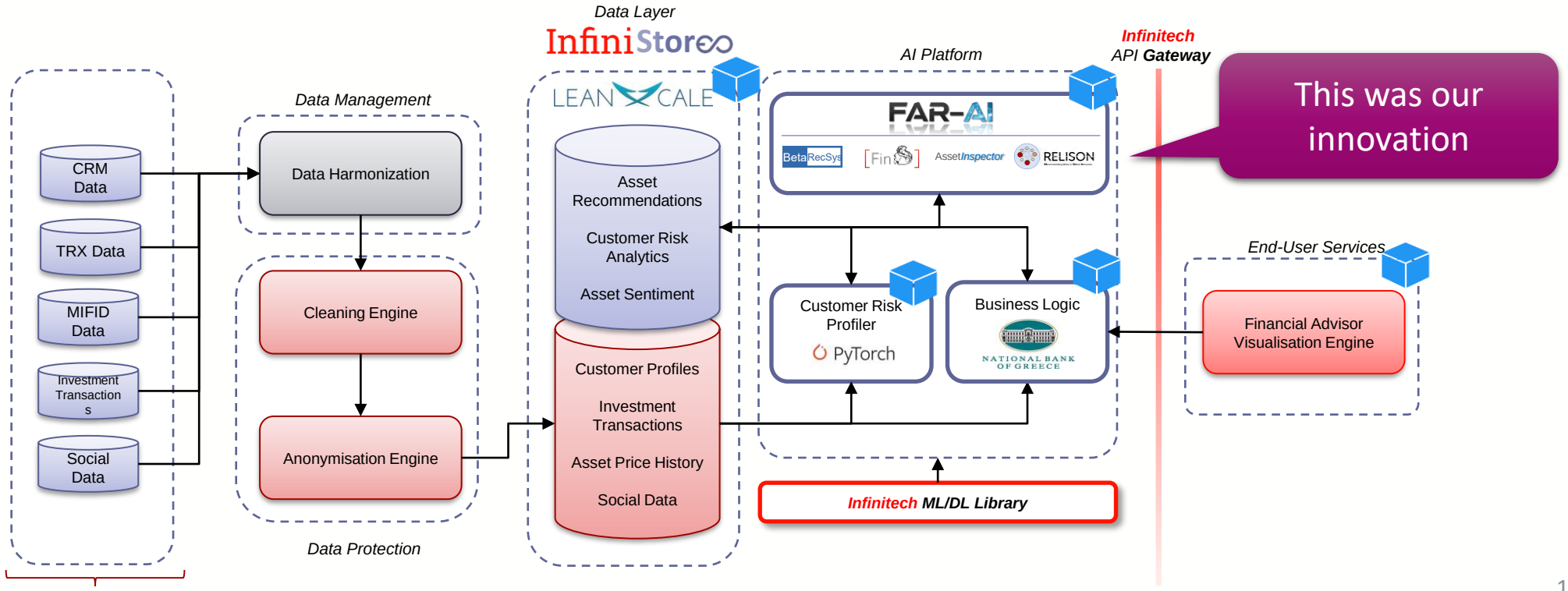
Goal: We were tasked to build a **financial recommender system** for banking customers (recommend investments)

- **Primary investigators:** Iadh Ounis, Craig Macdonald, Richard McCreadie
- **Dates:** October 2019 – March 2023

Research to Prototype

University of Glasgow
School of Computing Science

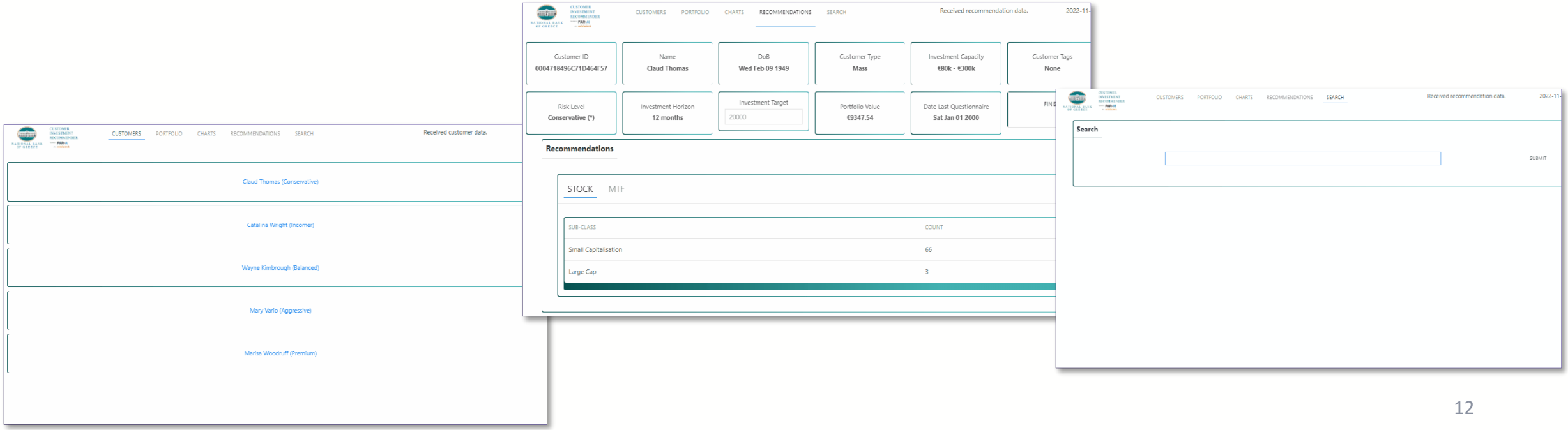
- As part of this type of project you usually advance your core technology and build a prototype for testing with a Pilot, in our case the National Bank of Greece
  - This is where you start to think about the practicalities of converting your innovation into a product (what you care about is often only a small part of a larger ecosystem)



Research to Prototype

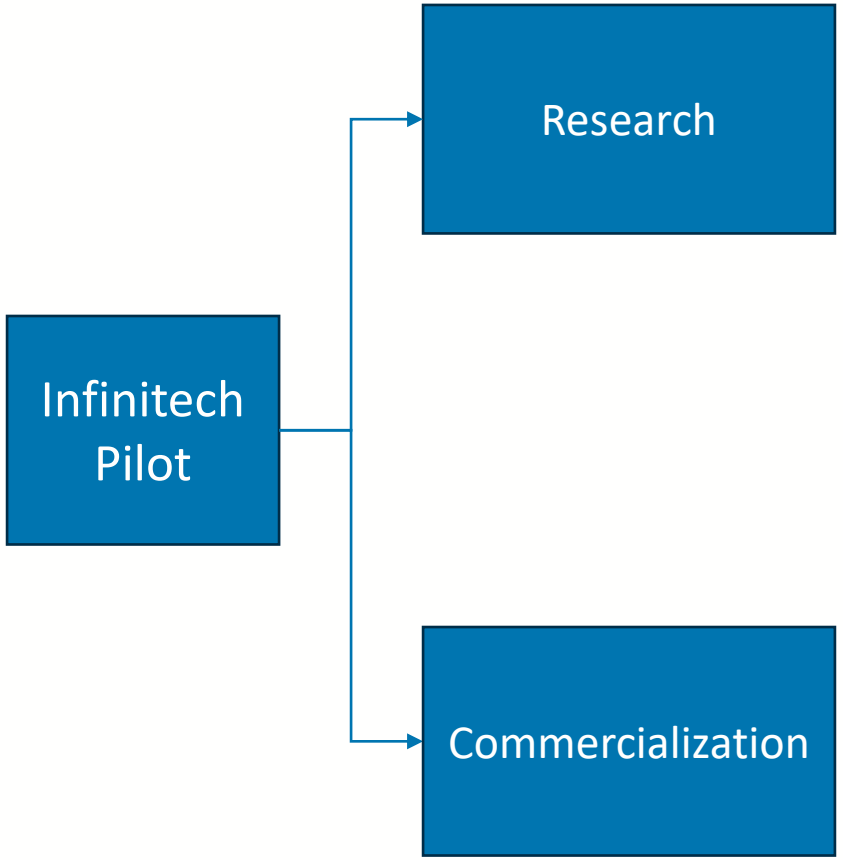
University of Glasgow
School of Computing Science

- As part of this type of project you usually advance your core technology and build a prototype for testing with a Pilot, in our case the National Bank of Greece
  - This is where you start to think about the practicalities of converting your innovation into a product (what you care about is often only a small part of a larger ecosystem)
  - If you are lucky, impact could happen here if the Pilot company wants to buy your solution, but usually more refinement is needed at this point



Infinitech ends March 2023… then what?

University of Glasgow
School of Computing Science

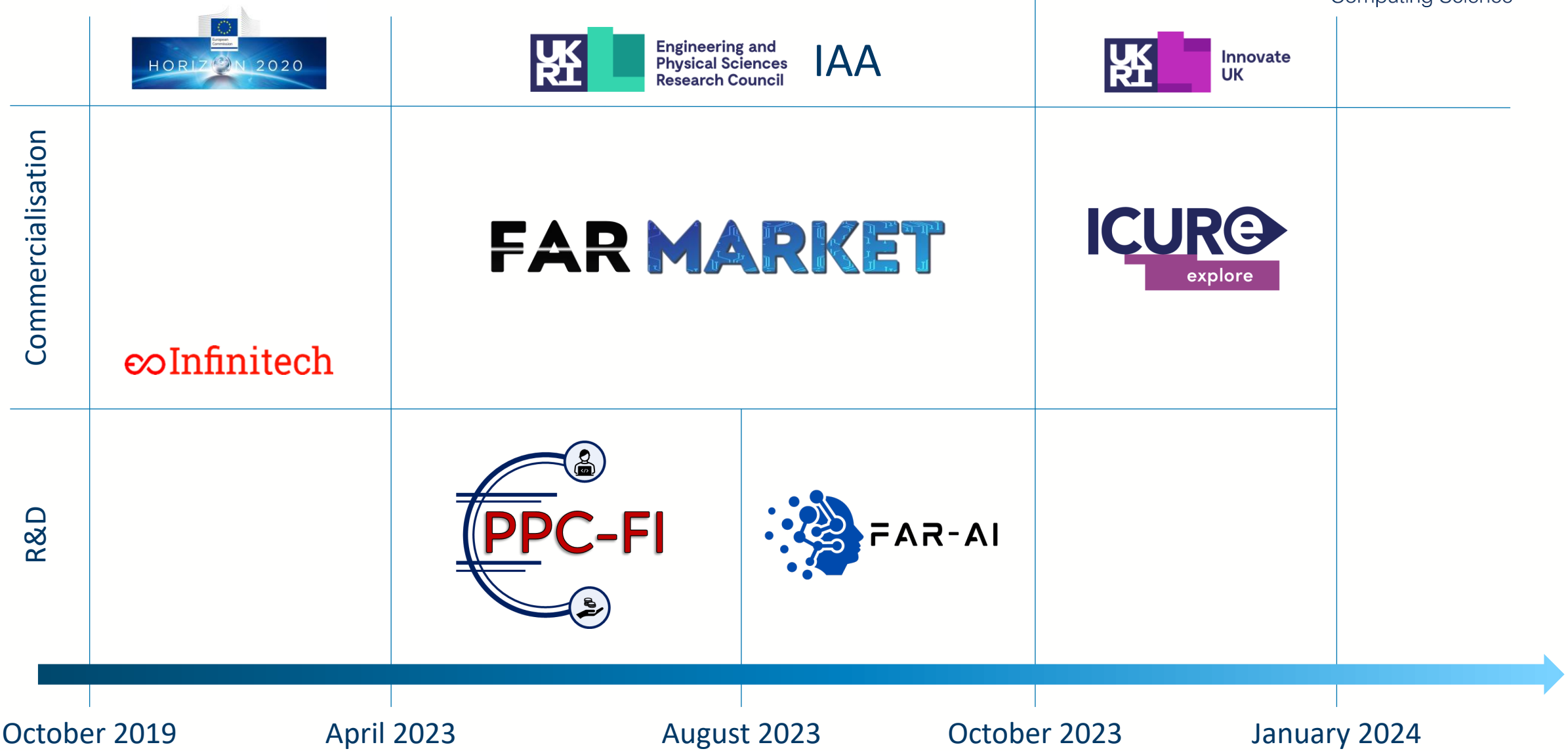


- Continue the financial informatics theme
- Keep partnership with the National Bank of Greece
- Improve our product

- License our technologies to NBG
- Potential to sell the product to third parties
- Creation of spin-out company

A timeline towards impact

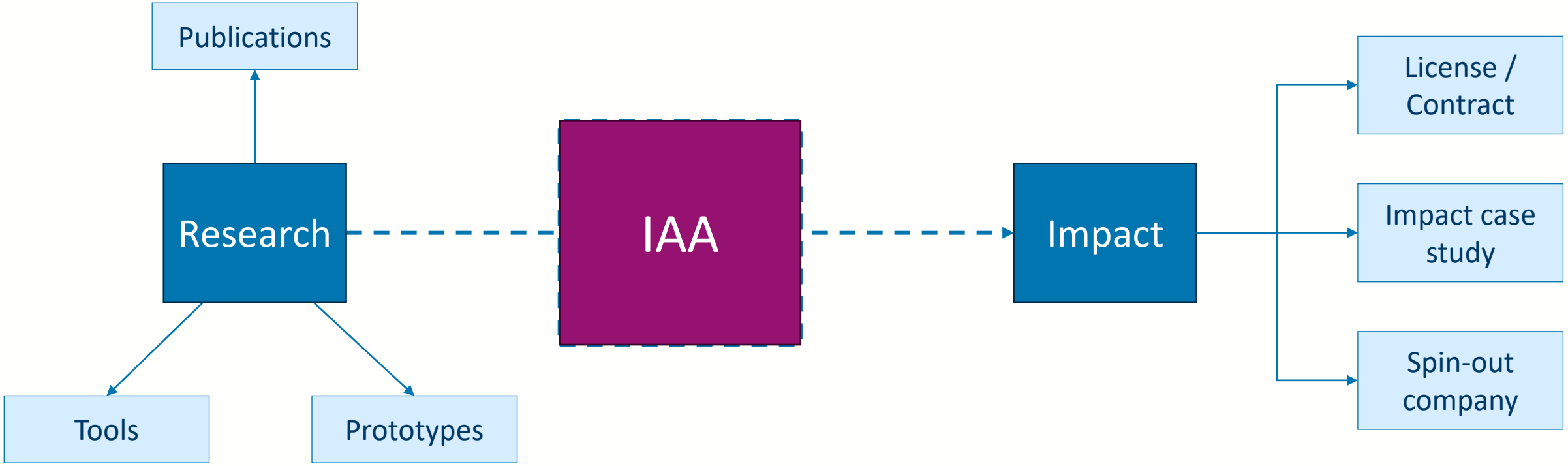
University of Glasgow
School of Computing Science



EPSRC IAA

EPSRC Impact Acceleration Account (IAA)

University of Glasgow
School of Computing Science



EPSRC IAA funds **innovation** projects aimed towards the creation of **impact** based on **existing research**

EPSRC Impact Acceleration Account (IAA)

University of Glasgow
School of Computing Science

- EPSRC IAA are **not** research projects!
  - New academic research is not eligible
  - Funding academic-only conference attendance is not allowed
- They are an **intermediate step** towards impact
- 2 types of projects: standard calls and RA-led calls

	Standard Call	RA-led Call
Primary investigator (PI)	Research & Teaching staff	Research Associates
Funding	Up to £50,000	Up to £20,000
PDRA time (estimated)	Up to 10 months	Up to 4 months
PI salary allowed	No	Yes

The EPSRC IAA process

University of Glasgow
School of Computing Science

- Identify impact route
- Engage collaborators
- Write proposal
- Gather support letters
- Send to IAA team

- Develop project
- Meet with collaborators
- Impact and outreach activities
- Engage with commercialization team (if needed)

- Write final report
- Report impacts (Enlighten KE)

Our IAA projects

University of Glasgow
School of Computing Science

Towards licensing / impact case study

PPC-FI

Towards commercialization / spin-out company

FAR MARKET

FAR-AI

The PPC-FI project

University of Glasgow
School of Computing Science

PPC-FI: Personalized Portfolio Construction for Financial Investments

- RA-led EPSRC IAA project
- **Funding:** £17,586
- **PI:** Dr. Javier Sanz-Cruzado
- April 2023 – July 2023
- Partner: NATIONAL BANK OF GREECE

Development of personalized portfolio recommendation and optimization algorithms for retail customers

Towards licensing / impact case study

Project concept

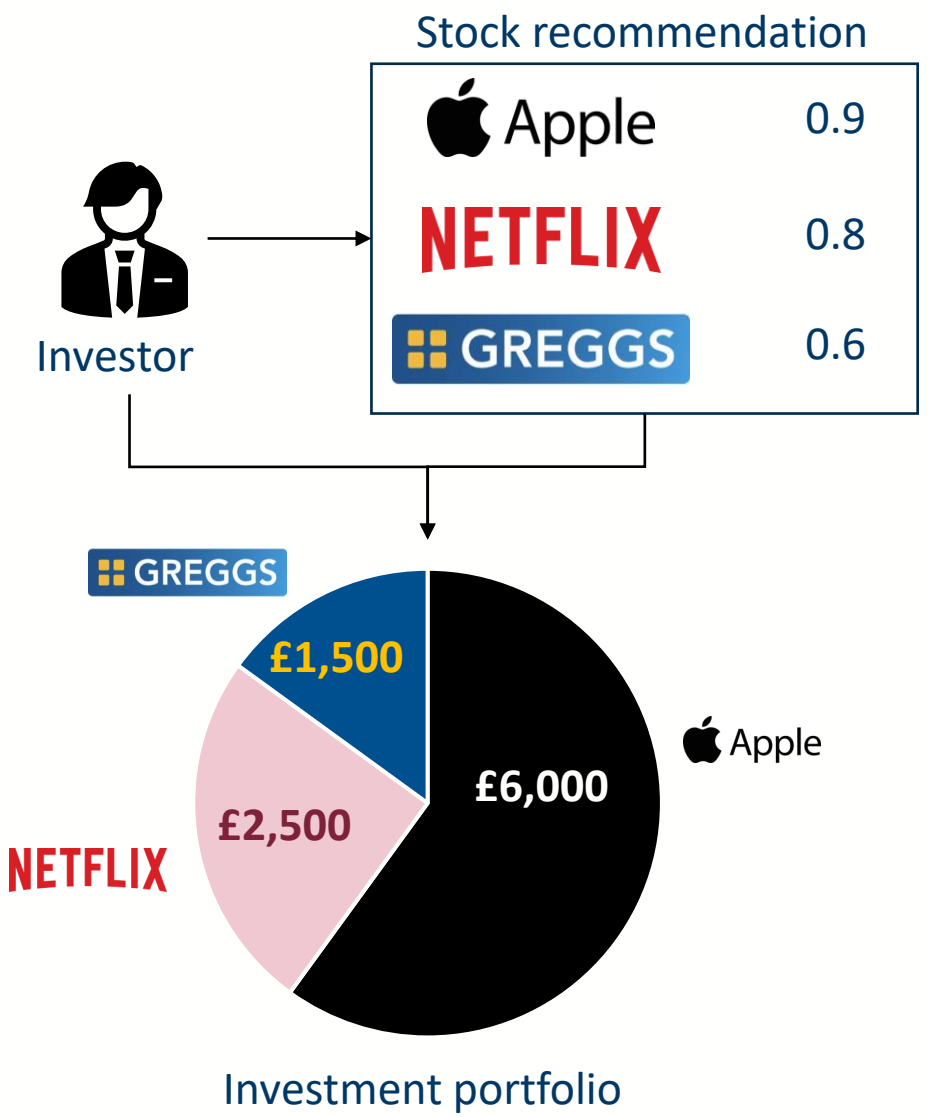
University of Glasgow
School of Computing Science

Improve and refine an existing prototype to license it to external partners

- No major research required
- Allowed continuous collaboration with NBG
- Potential application of research within NBG's daily operation (impact case study)

Project description

- Development of personalized portfolio construction algorithms
  - Identify financial assets for retail investors
  - And the amount of money they should invest on each
  - Adapted to needs of the investor (risk, horizon, capacity)
- Integration on the Infinitech prototype



Leasons learned…

University of Glasgow
School of Computing Science

- Focus on **impact**, not on research

- This is a **collaboration** with a partner, not a R&D contract
  - Get a strong support letter (including actual or in-kind costs from your collaborators)
  - What are the benefits for the University?
  - What are your partners contributing?

- Identify the benefits for the PDRA
  - IAA does not fund contract extensions
  - Clearly estate what advantages leading this project has for you.

- Ask for support from the IAA team (Keith Dingwall)
  - Pre-submission (form review)
  - Post-submission (improvement points and panel feedback)

The FAR-Market project

University of Glasgow
School of Computing Science

FAR MARKET

- EPSRC IAA project
- **Funding:** ~£35,000
- **PI:** Dr. Richard McCreadie
- June 2023 – September 2023

Identify potential markets into which we could sell our product

Towards commercialization / spin-out company

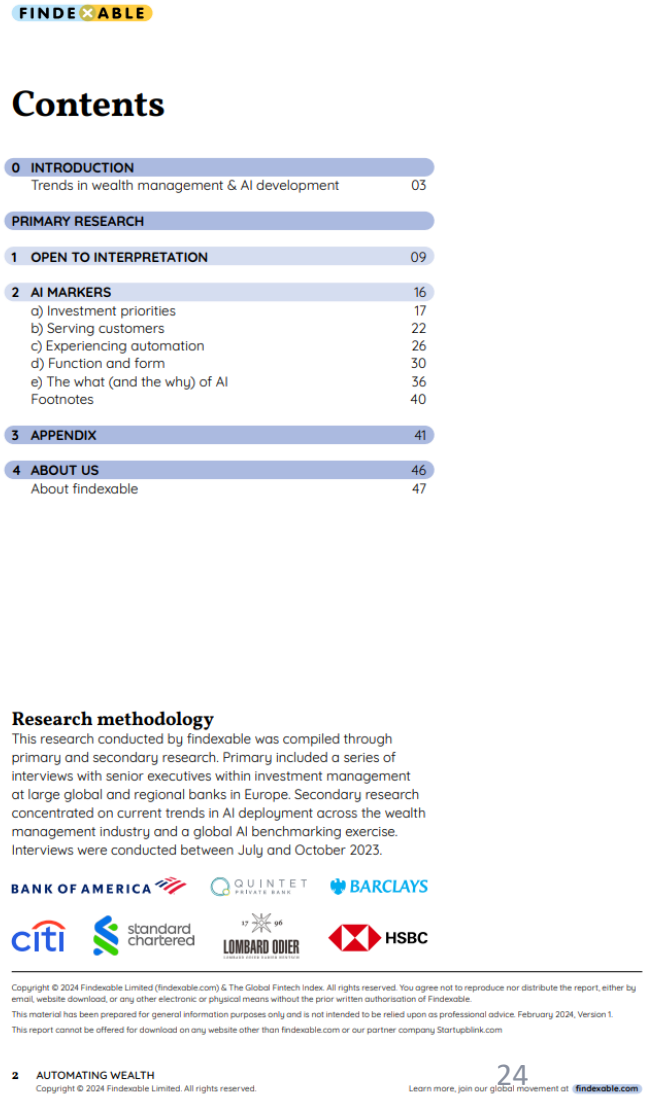
Project Concept

University of Glasgow
School of Computing Science

Pay a company to perform market discovery for us

- Tell them about our product
- Have them
  - Identify competitor companies
  - Interview potential customers
  - Write a report

You will need support from IP and Commercialisation to get this type of project approved


FINDEXABLE

Contents

Research methodology

This research conducted by findexable was compiled through primary and secondary research. Primary included a series of interviews with senior executives within investment management at large global and regional banks in Europe. Secondary research concentrated on current trends in AI deployment across the wealth management industry and a global AI benchmarking exercise. Interviews were conducted between July and October 2023.

BANK OF AMERICA QUINTET PRIVATE BANK BARCLAYS
citi standard chartered LOMBARD ODIER HSBC

Lessons Learned…

University of Glasgow
School of Computing Science

Its really difficult to get the University to pay an external contractor:

- Wrote the initial proposal in August 2022
- Submitted in January 2023
- Approved in March 2023
- Spent 6 months fighting with finance and legal over contract terms
- Project eventually started in around September 2023
- Report was delivered in January 2024

By the time we eventually finished this, it was already out of date:

- Our view on the product had changed
- We had a better idea of the landscape and had done our own market discovery by going to trade shows – which was much more useful

I don’t recommend this route!

The FAR-AI project

University of Glasgow
School of Computing Science

FAR-AI Deployment of AI-based Financial Asset Recommendation System

- RA-led EPSRC IAA project
- **Funding:** £10,658
- **PI:** Dr. Javier Sanz-Cruzado
- August 2023 – October 2023

Building a financial asset recommendation platform for the UK banking market

Towards commercialization / spin-out company

Project concept

University of Glasgow
School of Computing Science

Prepare an existing prototype for demonstration and commercialization

- No new research
- Make easier to reach interested third parties
- Potential for spin-out creation

Project description

- Collection of UK financial set
  - Remove constraints from external data
  - Adapt to the target market
- Development of new prototype features
- Celebration of a workshop on Scotland Fintech Festival
  - Title: “What’s my investment? Automated recommendations for investors”.
  - Date: October 5th 2023

SCOTLAND FINTECH FESTIVAL

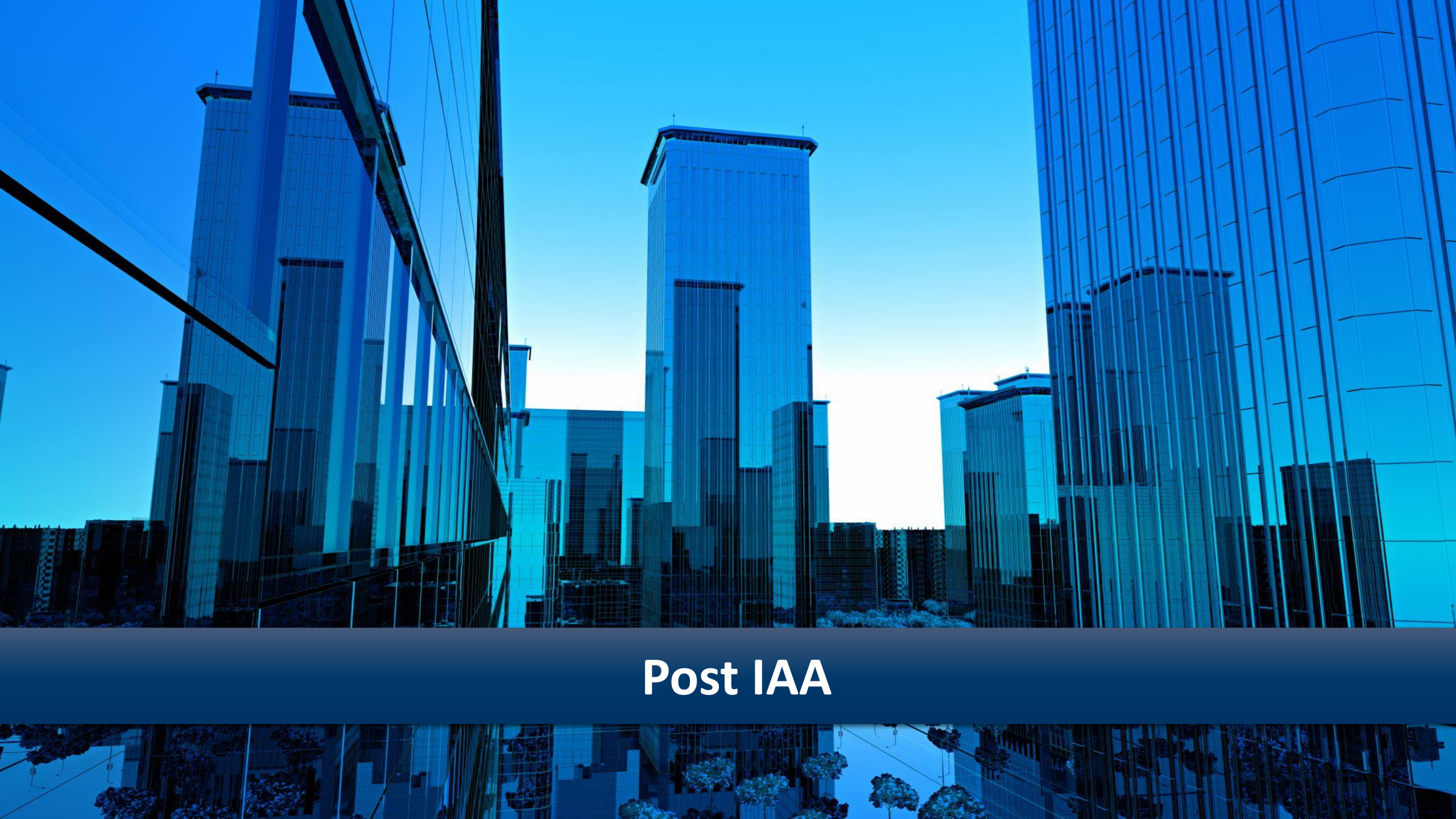
Prototype demonstration

Workshop materials

Lessons learned…

University of Glasgow
School of Computing Science

- Most lessons from PPC-FI project still apply here
- Although desired, you don’t need an external partner for IAA
- In that case, find support from IP & Commercialization team (Darian Brookes)
- **Building a product is not enough**
  - Impact cannot be created if we keep the products in our labs
  - Do not restrict to academic venues
  - Explore festivals and events to engage with interested parties
  - Show your product to others
- Be aware of the project timeline



Post IAA

ICURe Explore

University of Glasgow
School of Computing Science

- Innovate UK
- **Funding:** £35,000 (up to £15,000 for salary, £20,000 for market discovery)
- **PI:** Dr. Richard McCreadie
- October 2023 – January 2024

Explore the potential commercialization of research technologies

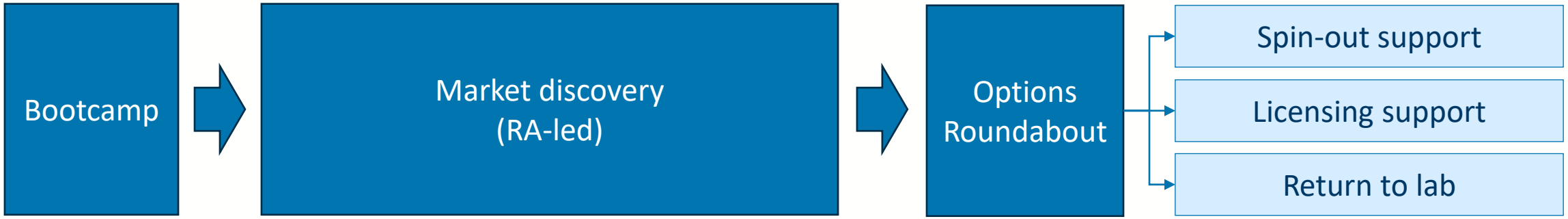
- The team
  - **Entrepreneurial lead:** PDRA / Early career researcher (Dr. Javier Sanz-Cruzado)
  - **Principal Scientific advisor:** Senior academic (Dr. Richard McCreadie)
  - **Technology Transfer Officer:** Commercialization manager (Darian Brookes)
  - **Business advisor:** Usually external to the University (Richard Braidwood)

Towards spin-out company

Programme concept

University of Glasgow
School of Computing Science

- 3-month support for market discovery activities
- Led by the entrepreneurial lead

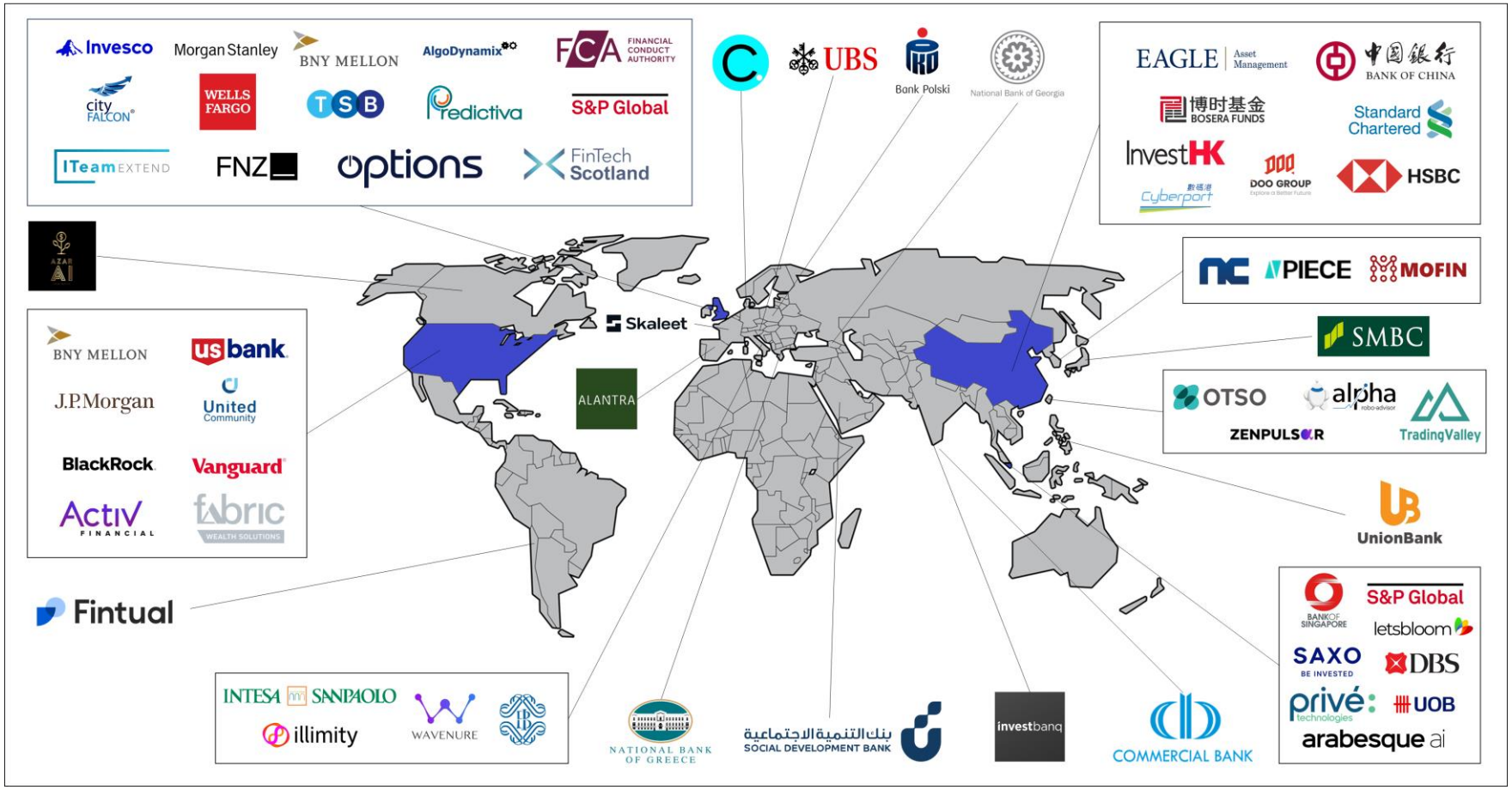


- What do we mean by market discovery activities?
  - Learn the current state of the market
  - Engage with potential customers
  - Identify partners, competitors
  - Establish the position of your research in the market

Our ICURe Explore journey

University of Glasgow
School of Computing Science

We explored the market by attending trade shows and conferences all over the world



7
EVENTS

>70
CONVERSATIONS

>50
COMPANIES

>20
COUNTRIES

Next steps

University of Glasgow
School of Computing Science

Towards licensing / impact case study

- Academia-industry research collaborations
- Further IAA collaborations

Towards commercialization / spin-out company

- Scottish Enterprise High-Growth Spinout programme
- Talk with investors

Lessons learned and advice

A PDRA Point of View

University of Glasgow
School of Computing Science

Pros

- Growth opportunities
  - Funding application training
  - Leadership and management skills
- Positioning yourself outside University
- Further collaborations with external partners

Cons

- Intermediate steps towards impact – need to secure funding before end of project
- Very short projects (up to 4 months without external funding)
- No time for generating research outputs

An Academic Point of View

University of Glasgow
School of Computing Science

Pros

- Innovation funding can give you momentum to turn some research you have been doing into impact – which is not only good for the country but your profile
- Even if it does not work, you learn more about what customers actually care about!
- Successful innovation activities can lead to impact case studies

Cons

- Its significantly more work added on to your normal schedule
- It might all be for nothing – most start-ups fail!
- Opportunity cost: working on this means less <everything else>
- The university is not that well set-up to enable innovation (yet)

Questions?

Dr. Richard McCreadie

Real-time IR, Machine Learning, Big Data Stream Processing, Evaluation

Richard.McCreadie@glasgow.ac.uk

Dr. Javier Sanz-Cruzado

Financial Recommendation Systems

javier.sanz-cruzadopuig@glasgow.ac.uk