

RESEARCH ARTICLE

# Open innovation programmes related to data and AI: How do the entrepreneurial orientations of startups align with the objectives of public funders?

Maria Priestley\*  and Elena Simperl

Department of Informatics, King's College London, London, United Kingdom

\*Corresponding author. E-mail: [maria.l.priestley@gmail.com](mailto:maria.l.priestley@gmail.com)

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**Key words:** accelerators; data ecosystems; entrepreneurial orientation; open innovation

**Abbreviations:** AI, artificial intelligence; B2B, business-to-business; DMS, Data Market Services; EO, entrepreneurial orientation; GDPR, General Data Protection Regulation; IPR, intellectual property rights; ML, machine learning; SMEs, small and medium-sized enterprises; USP, unique selling point

## Abstract

Open innovation programmes related to data and artificial intelligence have interested European policy-makers as a means of supporting startups and small and medium-sized enterprises to succeed in the digital economy. We discuss the objectives behind the typical service offerings of such programmes and propose a case for exploring how they align with the motivations of individual companies who are targeted by these initiatives. Using a qualitative analysis of 50 startup applications from the Data Market Services Accelerator programme, we find that applicants wrote most frequently about fundraising, acceleration and data skills. A smaller number of startups expressed interest in services related to standardization or legal guidance on General Data Protection Regulation and intellectual property rights, which are some of the ongoing priority areas for the European Commission. We discuss how the value propositions of these less desired offerings can be amplified by appealing the existing business motivations of data-driven startups.

## Policy Significance Statement

The current design of open innovation programmes in Europe has been informed by economic needs identified at the collective and regional levels. This orientation can pose a challenge to securing engagement from individual startups and small and medium-sized enterprises, whose personal business goals may differ from those of the collective ecosystem. Demand-side insights into the self-perceived needs of companies can help to design interventions that are more likely to interest them and make an impact on their business practices.

## 1. Introduction

Recent trends in policy making have addressed the directionality of innovation (Boon and Edler, 2018), with the transition to data and artificial intelligence (AI) technologies being among some of the most pressing socioeconomic challenges. Regulatory frameworks are continuously being developed for accessing and processing data, ensuring security and maintaining trust in AI technologies. Concerns of

this kind are being assimilated by public and private organizations, with startups and small and medium-sized enterprises (SMEs) being among those that have the agility to innovate and propagate the latest technical trends and best practices in the economy.

Ongoing challenges identified by European policy-makers include addressing the data worker skills gap, stimulating the diffusion of data-driven innovations and supporting a fair and competitive economy (Cattaneo et al., 2020). These objectives are being met through open innovation programmes that draw on the expertise of multiple organizations to provide training and mentoring services to data-driven startups and SMEs. Unlike traditional business incubators and accelerators, publicly funded initiatives provide more specialized training on topics such as data interoperability, standardization and legal aspects in order to support the formation of data value chains and ecosystems that can be sustained over the long-term.

In this article, we examine the demand from startups targeted by open innovation initiatives related to data and AI. A particular avenue that remains to be explored is the degree to which the self-perceived needs of startups and SMEs align with European policy objectives and the support that is available. While services that propel profitability and entrepreneurship offer clear incentives to businesses, best practices in standardization and legal strategy require companies to make substantial time and resource investments whose financial benefits may not be immediately apparent to them. Being positioned at the interface between startups and public funders, open innovation programmes offer a unique opportunity to gain insight into the alignment between their interests.

We begin with a discussion of the data innovation objectives that are advocated by the European Commission. We then elaborate on the different innovation practices that are required to sustain pan-European data ecosystems and the potential sources of tension that may arise between collective goals and the individual interests of companies. Our paper uses a sample of 50 company applications from the Data Market Services (DMS) Accelerator, one of the current innovation programmes operating in this area. We devise a qualitative methodology to assess how the entrepreneurial orientation (EO) of startups is implicated in their motivations to receive various support services. The analysis reveals some of the consistencies and divergences between the articulated demand of companies and the publicly funded support that is available to them. We use these insights to provide recommendations that can help to develop more effective interventions and harmonize the objectives of public and private stakeholders who participate in the European data and AI economy.

## **2. Background**

There is great diversity in the types of support programmes that are available to startups and SMEs in the digital economy. While private investor-led accelerators tend to focus on profitability and revenue, public funders try to stimulate regional economic activity by building “ecosystems” that entail technological development, collaboration and employment (Clarysse and Van Hove, 2015). Economic indicators such as the demand and supply of skilled data professionals, the number of data companies, their revenue and the value of the market for digital products have been monitored by the European Commission with a view to creating effective and lasting interventions (Cattaneo et al., 2020).

In the following section, we introduce the European Commission’s vision for economic ecosystems powered by data and AI and the interventions that are being created to support them. We then discuss the various innovation strategies that are accommodated by this vision, as well as their implications for participants at the collective and individual levels.

### **2.1. Big data ecosystems**

In line with emerging trends in the science of sustainability (Schlaile et al., 2020), data ecosystems rely on symbiotic relationships between different stakeholders. Within these systems, data and technologies can be reused and extended through complementary applications to create data value chains. “Big Data

Innovation Hubs<sup>1</sup> are being called to empower European SMEs and citizens to use and combine data sources from different sectors and communities. One of the key players of European data ecosystems is the Big Data Value Association (BDVA). This initiative is linked to a number of programmes that use an open innovation paradigm to create “purposive inflows and outflows of knowledge [between organisations] to accelerate internal innovation and expand the markets for external use of innovation” (Chesbrough, 2012). In the specific context of data and AI, this paradigm is being implemented in various ways, including: (a) common data spaces and (b) support programs for startups and SMEs. Each of these is discussed below.

The vision of pan-European data sharing spaces includes the creation of technical infrastructures and governance frameworks that make it possible to connect and valorize large datasets across different stakeholders (Lopez de Vallejo et al., 2019). By enabling companies to access data from other organizations, these initiatives stimulate the creation of new marketable solutions and recombinant innovations that address previously unforeseen uses. An important technical challenge in this process relates to the collation of data from multiple sources. In order to achieve interoperability and convergence of different solutions, it is important for data providers to adhere to common standards. Due to the time and resources required to participate in standardization, some companies are reluctant to invest in these collective goals. Other challenges relate to the ethics and legalities of handling sensitive data, which requires companies to be familiar with the General Data Protection Regulation (GDPR). Such issues of compliance and adoption are a priority in the European data strategy (EC, 2020a). Forthcoming legislation in this area aims to improve the operational conditions for reusing protected data and fostering trust between businesses that exchange data. Additionally, the EC aims to incentivize collaboration by creating alternative business models for monetizing data-driven innovations (EC, 2020b).

New companies entering the European data economy require specialized support to assimilate and succeed in this environment. Such support can come from individual organizations, for instance digital innovation hubs, which help SMEs with digital experimentation and resolution of issues around standardization, resourcing and training. On a larger scale, open innovation programmes deliver complementary support through consortia of public and private stakeholders, including business accelerators, dissemination managers, standardization bodies and universities. Their collective knowledge and experience are used to develop comprehensive training, mentoring and networking opportunities. One example of such a programme is DMS Accelerator.<sup>2</sup> DMS is a 3-year publicly funded initiative that was launched in 2019 with the intention of addressing the major hurdling blocks faced by European startups and SMEs specializing in data. Each year, 50 companies are selected to draw upon a catalogue of services related to fundraising, acceleration, standards and legal, promotion and data skills. Publicly funded programs such as DMS are characterized by their intensive training programmes. Unlike traditional business accelerators that prioritize the profitability of companies, open innovation programs seek to promote practices such as standardization and long-term legal strategy for the benefit of the collective ecosystem.

## 2.2. *Calibrating different innovation strategies*

The data ecosystems vision encourages companies to partake in collective goals by exchanging their data and innovations and actively adopting and creating common specifications for the industry. However, such as strategy may not always be practicable if companies wish to preserve market exclusivity or gain competitive advantages from their inventions (Husovec, 2018). Below we discuss how different innovation strategies such as open source, standardization, the use of intellectual property (IP) and GDPR compliance can be weighed according to their costs and benefits at individual as well as collective levels.

Traditional channels of knowledge and technology transfer in software industries have included open source development and standardization communities. Open source is a strategy that exposes technologies for free to the wider community, allowing other developers to test, improve and maintain software on

<sup>1</sup> [https://cordis.europa.eu/programme/id/H2020\\_DT-ICT-05-2020](https://cordis.europa.eu/programme/id/H2020_DT-ICT-05-2020).

<sup>2</sup> <https://www.datamarketservices.eu/>.

a large scale (Benkler, 2002). Pooled development of this kind has been beneficial to the growth of data science tools such as Python, a programming language whose diffusion and applications have exceeded that of equivalent commercial products.

Cooperative efforts that are characteristic of open source innovation can also be found in standardization communities. One of the ongoing challenges in software development relates to the variety of different solutions that can be developed to achieve the same task (Kim et al., 2017). Standardization communities reduce this complexity by agreeing on a smaller range of optimal solutions and eliminating the need for them to be repeatedly reinvented. By freezing the technical foundations of an industry, standards support the creation of cumulative, complementary and recombinant innovations as part of larger scale economic paradigms. In the specific context of data ecosystems, standards provide a means to link datasets through common formats and structures, as well as supporting the interoperability of data-driven services across different industry sectors. Interoperability is also being incorporated into the digital regulatory landscape, where shared standards and protocols offer a means to prevent datasets and innovations from getting locked into centralized proprietary systems (Riley, 2020). This helps users to stay in control of their data and to maintain competition.

SMEs and startups can become involved in standardization activities through chambers of commerce or associations<sup>3</sup> that support their participation as consumers or contributors. Although standardization requires substantial time and resources, learning about standards that already exist can provide young companies with core technical knowledge that protects them from developing redundant solutions. Standardization organizations can also serve as platforms for gathering tacit knowledge, building collaborations across industry networks and steering institutional knowledge into trajectories that are beneficial to the participants' own business goals (Blind and Böhm, 2019). Another incentive for companies to join standardization activities relates to the inclusion of their own IP rights in standards, such that other companies wishing to comply with the standard must also license the use of the patented invention. Standard-essential patents of this kind have been recognized to play a crucial role in the integration of digital components in technologies such as the internet of things (IoT) (EC, 2020b). However, licensing standard-essential patents is a costly process that has typically been a more popular strategy among larger companies. A report from the European Commission has observed that “too many companies, in particular SMEs... do not make full use of the opportunities offered by IP protection,” and that this “is largely due to lack of knowledge about IP” (EC, 2020b).

IP rights have been a controversial topic among software developers. Some standardization communities, such as the World Wide Web Consortium (W3C), actively eschew patents in favor of open innovation (Weitzner, 2004). Academics and technical experts have also argued that IP stifles innovation and slows economic growth by allowing the formation of monopolies that limit the usage of inventions (Boldrin et al., 2008). The European Commission takes a different stance in this debate, where it highlights that industries that make intensive use of IP contribute a significant portion of sustainable jobs to the EU economy (EC, 2020b). Europe's industrial ecosystem relies on IP protection to trade intangible assets, offering the incentives and security required to exchange high-cost innovations with collaborators whose interests may otherwise conflict.

In addition to collective collaboration, IP can support companies in their individual goals. One of the advantages relates to signaling innovative potential to prospective investors. For instance, patents were associated with higher amounts of money raised by software companies during their Initial Public Offerings (Useche, 2014). In the longer term, patents also confer the advantage of lead time, where competition can be blocked while the company develops its product and establishes collaborations. Without any form of protection, inventions that have multiple possible uses face the risk of getting locked into another company (a customer or competitor) who could patent a derivative work.

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<sup>3</sup> Examples of European organizations that support SME involvement in standardization include Small Business Standards and European Telecommunications Standards Institute.

In addition to the protection of inventions for competitive benefit, the protection of data poses separate challenges. Even if companies are willing to freely share the data generated by their business, this may not be possible with personal data. Regulations such as GDPR place restrictions on the ways in which data can be collected and processed, with companies needing to put in place security measures and act in the best interests of their data subjects.

Each of the above practices poses the challenge of creating and appropriating value between parties with potentially conflicting interests. This could include tensions between companies and customers in regards to the use of personal data, or the innovative partnerships formed between competitors. The collaborative context of data ecosystems requires companies to make investments, whether it be human resources in standardization or the monetary costs of data protection and intellectual property rights (IPR). Other trade-offs relate to the effects of exclusivity, where legal protection of inventions may mean higher rents, but a lower rate of diffusion compared to freely shared innovations. A critical understanding of the various innovation practices can help companies to make informed decisions.

### 2.3. *Entrepreneurial orientation of companies*

While public funders are keen to provide training and support in business practices such as standardization, ethical data management and IP for the benefit of European data ecosystems and the companies inside them, there is less clarity on how best to stimulate interest in these topics. Our paper takes a demand-driven approach to consider the individual values and tensions that arise in the companies targeted by these interventions. We suggest that the adoption of specific practices relies on the strategic stance that companies take for survival and growth. Attitudes towards exploration, risk and capability building may influence how data innovation will be monetized and incorporated into their business. In order to examine these decisions, we draw on theoretical constructs from entrepreneurship literature.

Entrepreneurship research examines the behaviors, practices and decision styles that firms use to differentiate themselves from competitors. One of the cornerstones of this literature is the concept of EO, which was launched by Miller (1983). The author observed that entrepreneurial firms tend to display common qualities such as engaging in product-market innovation, undertaking risky ventures, and being the first to come up with “proactive” innovations ahead of competitors. This list of characteristics was later extended by Lumpkin and Dess (1996) to include autonomy and competitive aggressiveness as processes that distinguish entrepreneurial firms, while Anderson et al. (2015) proposed a formative distinction between entrepreneurial *behaviors* and managerial *attitudes* towards risk as necessary components of EO. Over the recent years, a large number of frameworks and critiques have been published to address EO in different contexts and at different levels of analysis (Covin and Wales, 2019). The theoretical options presented by these various studies reflect differences in ontological grounding, specificity and field of interest. For example, critical discussions have explored whether entrepreneurship should be viewed as a single underlying phenomenon whose observable manifestations can be categorized, or if the categories themselves reflect separate constituents that form entrepreneurship.

Our study utilizes a generalizable and parsimonious definition of EO that has retained its integrity despite ongoing debates regarding conceptual domains, the nature of the dimensions and the relationships between them. Specifically, the three dimensions of: (a) innovativeness, (b) risk-taking, and (c) proactiveness have been shown to be significant and empirically distinct in prior studies (George and Marino, 2011). This categorization enables our empirical observations to be classified in a manner that is consistent with prior studies, helping to position our analysis in the context of wider entrepreneurial research and to make our findings meaningful to the large community of researchers who already use EO constructs. Due to the exploratory nature of our study, we choose not to impose from the outset any additional dimensions or distinctions regarding the attitudinal or behavioral aspects of entrepreneurship. However, the emergent themes of this preliminary study could help to identify some of the salient concepts in data and AI entrepreneurship that can inform the selection of more precise frameworks in future.

Within the canonical EO framework, the concept of innovativeness is typically understood to reflect a company's tendency to embrace new technologies or practices that go beyond their established norms. In the case of data and AI, this could include improving a product, service or process through automation. Risk-taking refers to the company's willingness to commit substantial assets towards causes that have a chance of loss or failure. For example, working with personal data could pose a risk to the company's reputation if the security of those data is breached. Lastly, proactiveness refers to the shaping of the market configuration, industry standards or company strategy to stay ahead of competitors. In contrast to reacting to industry conditions in real time, proactive companies can monitor trends to time their product to current conditions and to anticipate future demand. Together, the three dimensions of EO offer a structure for reasoning about the various different motivations behind business practices.

To our knowledge, the specific business activities that form part of data innovation have not yet been defined using the EO framework. However, the relevance of this construct to the data economy has been supported by Dubey et al. (2020), who found that the EO dimensions are a statistically significant predictor of firms' tendency to adopt big data analytics powered by AI. The authors used a closed-ended survey format to assess each aspect of the framework. For example, the dimension of proactiveness was evaluated by Likert-style questions such as: "To what extent does your organization tend to talk more about opportunities rather than problems?" Our paper builds on this prior work to deliver new qualitative insights into the specific practices and challenges presented by data and AI technologies within each EO dimension. In the following section, we describe our approach to analyzing how data-driven startups and SMEs have exhibited their EOs through the various operational and behavioral processes described in their applications to DMS Accelerator.

### 3. Research Design

We created a multi-dimensional coding framework based on the three EO categories (proactiveness, innovativeness, and risk-taking) divided according to the service categories offered by DMS Accelerator (including standardization, IP and GDPR alongside more profit-oriented services such as fundraising and acceleration). Table 1 provides examples of the themes accommodated by this framework.

#### 3.1. Data collection

Our data comes from the application forms of 50 successful startups who participated in DMS Accelerator in year 2020. The programme selected these startups out of 206 applicants by assessing their motivation to join the program, interest in its services, commitment to equal opportunities in employment and the data-driven focus of their business. Companies were intentionally selected to represent different stages of maturity, with 30 validating, 15 scaling, and 5 establishing companies chosen to give priority to those in earlier stages. Validating companies are younger and most likely to require specialized skills and growth hacking, with our sample having small teams of five employees on average. Scaling companies are more developed in terms of exploring their market fit and early revenue, with eight employees on average. Establishing companies are the most mature in their readiness to expand into new markets and securing ambitious investments. In the present sample, these startups had 10 employees on average. In terms of geographic coverage, the sample comes from 20 European countries, with major portions of companies based in the UK ( $N = 10$ ), Spain ( $N = 6$ ), Netherlands ( $N = 5$ ) and Portugal ( $N = 5$ ). The most prominent sector categories included AI/ML ( $N = 24$ ), healthcare ( $N = 12$ ), cybersecurity ( $N = 10$ ), retail manufacturing ( $N = 8$ ) and smart cities ( $N = 8$ ). Most applicants selected multiple options, with 13 sectors represented overall.

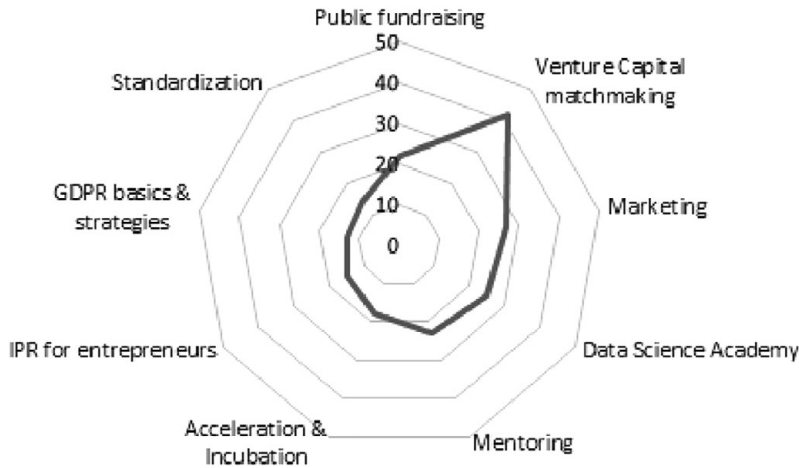
Open innovation initiatives such as DMS routinely gather data about startup needs and motivations for joining the program. The range of services offered by DMS, in combination with the applicants' desires to join, provide an opportunity to gather insights about the value that companies assign to the various

**Table 1.** Emergent themes at the cross-section of different entrepreneurial orientations and business practices of data-driven startups

	Entrepreneurial orientation		
	Proactiveness	Innovativeness	Risk-taking
Fundraising	Funds to grow human resources, operations, mass production and marketing. Introductions to investors and fundraising strategies	Raised funds put towards developing technical infrastructure, prototypes and validation of technology before releasing to customers	Investing own money in the business Difficult funding landscape due to Covid Lack of knowledge about fundraising
Acceleration	Expansion into new markets (geographies and industries). Turn startup into a business that generates revenue	Creating novelty in the market and amplifying their USP Commercializing their invention	Having technical skills, but lacking entrepreneurship Avoiding business mistakes
Data skills	Data solution as the unique trait that separates them from competitors Data skills required to advance their solution in future	Data analytics used to implement something in a new way (All selected companies had a USP related to data. This code was used only if they wanted to develop this)	Heavy computational and financial requirements Having the skills in business and sector knowledge, but lacking technical skills Algorithmic bias and Public skepticism of AI
GDPR	Privacy used to raise business reputation and leadership	Novel solutions that entail personal data Developing new features related to privacy	Risk of working with personal data Regulatory constraints
Promotion	Go-to-market strategy. Gaining more customers and sales (esp. B2B sales)	Using data to optimize the marketing strategy	Difficulty of growing sales in a new/niche market Lack of marketing and sales knowledge
Standardization	Competitive advantage of interoperability Developing industry wide methodologies and benchmarks	Adopting industry standards within their inventions Inventions that involve integration of datasets	Regulatory constraints Mitigating inefficiencies
IPR	Using IPR to drive investment	IP for data and ML models New business models based on IP	Lack of legal skills Protecting IP from competitors

different training services that are available. The text answers used in our study originated in response to the following questions:

- What is the unique selling point (USP) of the company?
- What issues do you face as a company and how will this program's services benefit you?



**Figure 1.** Most commonly selected training and support options at DMS Accelerator.

- What specific skills or knowledge would you like to acquire through these services and how will they benefit your business and product?
- What's the expertise and background of your core team?
- What's your company's vision for a 5-year plan?
- How would your company use this investment round?

Additionally, we used answers from a closed multiple choice question:

- Which training services would you be interested in receiving? (up to 5; the options are shown in Figure 1)

### 3.2. Data analysis

We analyzed the startups' written answers to the application questions using NVivo 11 software. References to their specific accomplishments, challenges and motivations were classified according to the qualitative coding framework in Table 1. The number of mentions in each code were visualized using a bubble chart to show the relative amounts of attention received by each business practice.

Given the nature of the application forms, many of the written answers were framed around the DMS training and support offering. In some cases, these services were listed without elaborating the reasons. For example, the statement: "we want to learn about IP and fundraise and DMS provides these services" would not provide sufficient information for inclusion in our coding matrix. However, the framework would accommodate statements such as: "We wish to understand how patents can be used to protect machine learning (ML) models and understand how IPR is valued by investors." This would be coded at the intersection of IP and risk-taking ("protect"), as well as innovativeness ("ML models") and proactiveness ("how IPR is valued by investors"). In this way, EO offers a structure for extracting and classifying meaningful entrepreneurial motivations behind each desired service.

Our methodology still accommodated expressions of interest in services that were not sufficiently detailed for inclusion in the qualitative coding matrix. For this, we used the multiple choice responses containing the list of services which companies were interested in receiving. These responses were visualized using a radar chart in Figure 1. We also compared them with each company's qualitative answers to account for possible gaps between their manifest and latent needs. For example, if a company



expressed an interest in data interoperability but did not recognize standardization as a relevant service, this would imply a latent need.

## 4. Results

Figure 1 shows the number of applicants who indicated that they wish to receive a particular DMS service using tick boxes. Figure 2 shows the distribution of written references at the intersection between different business practices and EOs. We found that topics related to fundraising, acceleration and data skills received relatively more attention compared to GDPR, promotion, standardization and IPR. Additionally, there was a greater tendency towards proactiveness within the more popular categories. Examples of the emergent themes are discussed below.

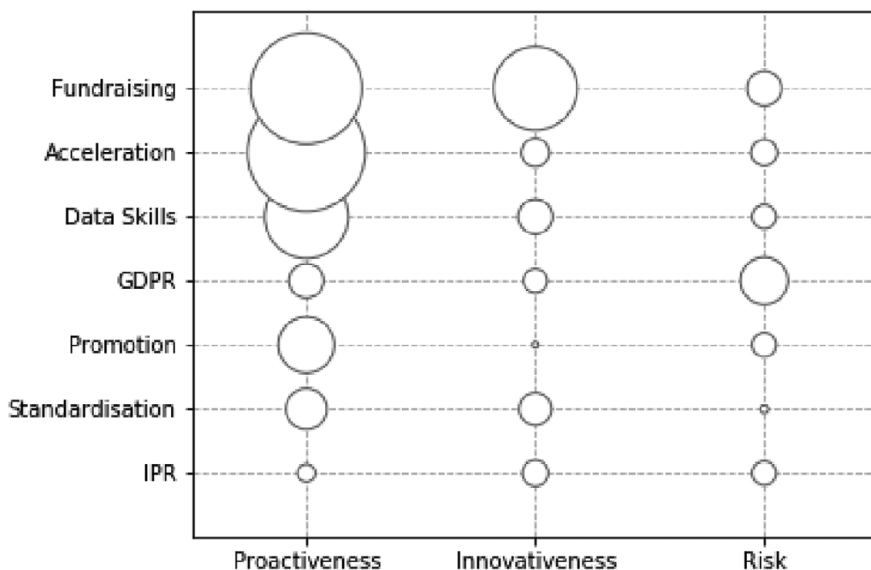
### 4.1. Acceleration

#### 4.1.1. Proactiveness

Most startups were interested in Acceleration as a means to scale their business. This commonly entailed expansion into new markets, both in terms of geographies and industry sectors. One startup wished “to acquire knowledge on best practices in operating in Central Europe as well as potential strategic partners that already sell industrial software technology.” Several startups wanted to refine their value proposition and product fit within their target market by receiving support through mentorship, commercial leads, strategic partners or like-minded communities.

Another theme in this dimension was commercial tactics related to scaling operational capabilities and pricing strategy. One startup had the vision “to create a scalable SaaS business with predictable revenue,” while another planned to “gradually extend our target market from P2P marketplaces, to B2B, B2C, insurance, sharing economy and gig economy.”

The various forms of scaling above (market, product and sales) were frequently mentioned together as part of the companies’ future plans. For instance, one of the 5-year visions was: “1. Accelerating



**Figure 2.** Bubble chart showing the written attention received by different business practices and entrepreneurial orientations. The size of bubbles reflects the number of references coded in each intersection.

technology development and reaching the global market faster 2. Thorough market validation and product-market-fit to build a longer sustainable growth model 3. Prepare battle tested technology, core team and international sales channels for scaling up.”

#### 4.1.2. *Innovativeness*

At the intersection of Acceleration and Innovativeness, startups spoke about developing a minimum viable product (MVP) and validating it in new markets. Various types of markets were covered here, including those based on product features, target audience (individuals vs. businesses) and geographic region. For example, one of the startups wanted to “scale solution across retail & mobile data analysis sector + validate healthcare analysis case in Spain... Scale healthcare case in Germany + deploy more features and traffic in our platform to become more of marketplace.” Numerous respondents were also keen to enrich their USP by leveraging third party data and creating integrations between platforms. One of the startups hoped to “leverage the power [of] other open sources and public org ... to outreach the solution of [our company] to European union and another part of the world to create a bigger impact.”

In addition to securing expansion through innovation, some applicants were interested in building new business models based on data. This meant either commercializing their solution or monetizing the data generated by it. In the latter, several respondents were mindful of the origins of data, for instance by focusing on third party data or first party data as their USP.

#### 4.1.3. *Risk-taking*

Several startups felt disadvantaged compared to larger companies when it came to accessing the market. This struggle included adoption by prospective customers and securing access to data: “On one side big companies and GAFAs are generating data, on the other side SMEs and startup that cannot get access to data for different reasons: availability, cost, legal issues and privacy.”

Others were conscious of mitigating the risks presented by their industry. For example, healthcare startups invested substantial time and resources to secure CE marks and FDA clearances for their product. Other startups wanted to “avoid learning through mistakes as much as possible” and to mitigate inefficiencies. For instance, one company stated: “We are all engineers and constantly feel we lack (that might not be true, but the feeling persists) in some business making skills. This feels especially true when we sign new contracts or negotiate for new deals. It always feels we should get the better deal that we did.”

Many of the startups had strong engineering teams, but felt a lack of human resources to effectively scale their business. Needing to develop additional skills internally as well as receiving external guidance appeared to be one of the main motivations for signing up to the program: “There are a lot of business challenges, legal and fundraising activities that we are currently getting on an ad-hoc basis from friends and our network. This is where we’d benefit from DMS.”

## 4.2. *Fundraising*

#### 4.2.1. *Proactiveness*

Most of the observations in the Fundraising category originated in response to the question: “How would you use this investment round?” As shown in Figure 3, Common expenditures in this area included the marketing strategy and technical infrastructures for taking their product to market. For example, some wished “to fund marketing and technology costs. When we have a proof of concept from our MVP, we will require capital to explode our app onto the London market.” Others also wished “to license data to open new markets.”

Alongside these ambitions, many startups wished to increase their human resources and meet “operational costs (supporting the existing team and growing it to accelerate product development).” Several applicants were explicit in stating that they need to hire more data scientists, sales and marketing staff.

In many cases, the responses resonated with themes that emerged in the Acceleration category. Fundraising was viewed as a means to achieve the internationalization, product commercialization, compliance and market fit that were necessary to scale their business. For example, a healthcare startup



**Figure 3.** Word Cloud illustrating the content of the Fundraising-Proactiveness category.

provided a list of potentially costly activities: “We want to acquire quality and CE certifications. We need to start B2B sales with leading IT vendors. We need to showcase at events and exhibitions to increase our visibility in the market.” Other expenditures included trips for establishing commercial partnerships. For example, as a “financial basis to reach the goals outlined earlier: scale our network of data providers, reseller channels and distribution channels.”

Respondents who did not focus on expenses sought to use the fundraising round as a way to get introductions to venture capitalists, while others wanted to develop an “understanding [of] how to apply for EIC [European Innovation Council] and gain institutional funding.”

#### 4.2.2. Innovativeness

A major theme at the cross-section of Fundraising and Innovativeness was the improvement of software and algorithms upon which the company’s product was based (Figure 4). While some respondents focused on the use of funds to fulfil the technical requirements of innovation and research, others underscored the earlier stated need for human resources. For instance, they needed to “add in significant data analytics capabilities, hire data analysts & utilize subcontracting, add new AI features for our service platform.”

In addition to product development, others commented on the subsequent need to validate their product through field tests or pilots. For example, in the healthcare industry, “we need to further train [our AI



### 4.3. Data skills

#### 4.3.1. Proactiveness

Many startups were keen to acquire new Data Science skills as a way to advance their position in the market. They wanted to “develop efficient, effective, and ethical data science tools” or “to integrate and automate different data sources” to gain a competitive advantage. A considerable portion of respondents expressed Data and AI skills as a key competency for establishing their market leadership. Some stated that “the customers using our solutions over competitors have the added advantage of analytics, blockchain proofs, and ethical standards.” Others offered “a defensible modelling methodology [which] affords us protection against competitors and a defensible market position.”

#### 4.3.2. Innovativeness

Applicants discussed how data skills could help to introduce novel product features or to improve their invention. For instance, one of the companies was “looking to enhance our product with a ML component.” Another stated: “We track carbon emission to an unprecedented level of granularity by combining energy flow modelling with geospatial information mapping. We need machine skills to improve these models.” It is worth noting that most of these applications of Data Science referred to product innovation as part of their business offering, with very few examples of internal process innovations. In the latter, there was one company who wished “to develop ML algorithms to optimize community engagement,” providing an example of how automation could help to streamline internal business operations such as marketing.

#### 4.3.3. Risk-taking

A number of startups were dealing with various forms of skepticism surrounding AI. For some, this meant taking extra steps to ensure the accuracy and validation of their solutions for the customers, while others were actively “building solutions to fight biased AI, fake news & misinformation.”

Some of the respondents were conscious of their lack of data skills and a need for assistance. This was especially common among those whose current team experience leaned more towards business development.

A small proportion of responses also recognized the technical limitations of deploying Data and AI. They wanted “to explore which ML models and toolsets are most efficient in reducing the computational resources required to support our analysis and are deployable for commercial products.”

### 4.4. Personal data and GDPR

#### 4.4.1. Proactiveness

Compliance with GDPR was frequently presented as a necessity to commercial success. Some stated that “GRPR compliances will allow us to compete,” to “expand use case for our product” and increase “the perceived value of our products.” Another startup was concerned with “making sure we are seen as maximally compliant with regulations, but also that we implement absolute best practices for data privacy and InfoSec.”

The interest in best practices was reflected by several startups who focused on the benefits that would be gained by their customers. Some of them wanted “to empower market participants with credentials that facilitate trustless interactions on digital platforms,” or “to learn best practices for health/medical data management in a way that considers consent, privacy, ethics, risks, and benefits to the patient.”

Others wanted “to become Subject Matter Experts on data privacy and its regulation. We help organizations that work with sensitive data and we are positioning ourselves to be thought leaders on this subject.” Expertise on GDPR was also viewed as an opportunity to tackle skepticism and increase the adoption of their product. A smart cities startup shared that “when cities and administrations do not know data gathering regulations[,] they tend to refuse smart city projects. By being knowledgeable on the topic,

we can help cities and administrations better understand the challenges that smart city project imply, leading to better acceptance.”

#### 4.4.2. *Innovativeness*

A number of startups’ innovations relied on the use of personal data, with some prioritizing “first party data (as opposed to all competitors that are focused on selling third party data).” Some of these developed innovations with the specific goal of preserving personal privacy: “Our privacy algorithm synthesizes randomization, generalization and aggregation techniques, making it practically impossible to track back any data to individuals.”

#### 4.4.3. *Risk-taking*

The category of Personal data & GDPR was unique in that most of its references were coded under risk-taking. Startups who were working with personal data wanted to do so “without invading users’ privacy” and “to ensure all GDPR and data privacy protections are in place.” They felt that “dealing with data has many challenges, being the privacy of the individuals that the data refers to, one of the biggest.” Another startup said: “While we are already heavily concerned about this and have made some concrete steps from a regulatory and information security perspective, there is always more to learn and do.”

Several startups who relied on personal data felt that their “efforts are hindered by legal and privacy issues,” and that they need additional legal and technical skills. One startup shared: “In the field of our privacy sensitive data part, we believe the concept about trust building will be very helpful. Although experienced with DPIAs [Data Protection Impact Assessments],” they were interested in incorporating new security measures into their business operations.

Others were more concerned with how their data management was perceived by external collaborators. For instance: “We are marketing to and working with large food retail companies in Europe and North America, and they are very strict on how we deal with GDPR, data science and business.”

### 4.5. *Promotion*

#### 4.5.1. *Proactiveness*

In the category of Promotion, startups were interested in communicating their value and establishing a brand within their target market. The general sentiment was “to acquire more expertise in marketing and sales actions and especially how to enter different markets.” For some, this meant “the ability to communicate how data strategy fits into digital strategy with the EU single market,” while others felt that the social networking opportunities presented by the program would “help us gain the partnerships we need to strengthen our visibility and reputation in the UK.”

Growing their customer bases and sales was a recurring interest among the applicants. A considerable portion of them were especially interested in business-to-business (B2B) sales and marketing. For example, one company wanted to “learn more about marketing strategies for a Data based company, how to reach the possible customers (public institutions or even big corporations) so they can better understand how our solution can help them.” Concerns such as this typically fed into their go-to-market strategy.

#### 4.5.2. *Innovativeness*

Only two references were coded at the intersection between Promotion and Innovativeness. These came from companies that wished to use innovative data science solutions in their marketing efforts. One company wanted “to use data to optimize our marketing strategy,” while the other was an earlier mentioned case that wished “to develop ML algorithms to optimize engagement in the communities and suggest what post types will get the most user engagement.”

### 4.5.3. Risk-taking

Numerous startups listed marketing and sales as areas they wish to improve under the guidance of the programme. Some expressed struggles with creating visibility or reaching their target market. For instance: “we lack expertise in the area of data management and marketing and sales tools for our niche market; therefore, we strongly believe that these training sessions will allow us to gain a deeper knowledge on these issues and learn from best practices and other case studies from companies/experts.”

While some viewed the programme as a way to learn and develop their skills in marketing, others felt it could directly help to mitigate their current struggles. For example: “we do not have the resources to do marketing & sales during these times. Marketing opportunities will help us a lot to attract inbound sales.”

## 4.6. Standardization

### 4.6.1. Proactiveness

For a number of companies, their perceived market position and leadership relied on data exchange and integration. Many of them sought to “offer an easily integratable platform” or to ensure that “underlying technology integrated in homes, cars, hospitals and various wearable devices.” Others sought to establish themselves in a field where “synthetic data will be the standard format for data science and organizations will be able to exchange data in a privacy preserving manner.” It is interesting to observe that despite working on interoperable solutions and data exchange, these forward-looking startups did not indicate standardization as a service they wished to receive. It is possible that they felt these intentions could be met by Data Science training. For example, the earlier mentioned category of Data Skills contained the reference: “we need to integrate and automate different data sources so we need to improve our Data Science skills,” suggesting that some startups may have viewed integration as an issue that required data science skills rather than standardization.

Startups that explicitly requested standards training appeared to do so for two reasons. One of these motivations was compliance within their respective market. For one startup, this meant “a compliance-ready platform for standardized traceability systems,” while others were conscious that “the data we manage could be commercially valuable only if based on technical and GDPR standards.”

Other requests for standardization training appeared to come from companies who were more interested in the participatory aspect of standardization. They wanted “to understand how consensus is reached for developing industry wide methodologies.” Some wished “to engage with the data community to help us learn, share and benchmark technical and legal standards in the industry especially with proprietary datasets and shared data ownership.” These benefits could be sector-specific, for instance: “We can lobby and work on data standards in Logistics and supply chains in Europe. This is what we do already and the additional skills will help us in improving our business and make the world a better place.” Another startup had a broader goal “to become the ‘CISCO for user data integrations’ in Europe.”

### 4.6.2. Innovativeness

The cross-section between standardization and innovativeness contained references to specific innovations that are already compliant with standards or an interest in using them to further innovate the solutions. Startups took pride in adopting the latest technical standards, for example: “The solution is compliant with the brand new W3C standard for Verifiable Credentials, and is also 100% GDPR compliant.” Others’ innovations were informed by sustainable standards that went beyond the technical. For instance: “Our specialty comes from satellite data sources, automated and semi-automated data pipelines, and use of the SDGs (sustainable development goals), and ISO standards of sustainability as guidance frameworks.”

Startups who were interested in using standards to further advance their innovations proposed using “meta-data scraped from the internet to enrich the platform,” “find efficient ways to standardize report

generation and due diligence of finished projects,” or to “overlay third-party data sources to make the data more robust.”

#### 4.6.3. *Risk-taking*

A small number of startups sensed that standardization could help to mitigate some of the risks of operating in the data market. However, the nature of these challenges was different across the three available references.

For one startup, standards were a way to address inefficiencies: “Currently we lose a lot of time and money customizing each report to our customers and one of our next milestones is achieving high levels of standardization.” Another startup requested “data standardization” because “as a platform handling data & marketplace services we are challenged with a lot of legal questions.” The legal undertone was also present in another respondent, who requested help with “GDPR, Data Management and Standardization” to “design the product data model including regulatory constraints.”

These responses reveal multiple understandings of how standardization is practiced. Some viewed it as a way to implement technical guidelines, while others focused on ethics or best practices in business. In the latter, the respondents already had “solid skills on technical implementation of such related requirements,” suggesting an interest in developing a more holistic understanding of industry standards.

### 4.7. *Intellectual property rights*

#### 4.7.1. *Proactiveness*

Several companies were interested in IP as a way to increase the value of their company. They wanted to “understand how IPR is valued by investors,” “to sustain our product and to target the right venture funds.” One company wished to spend funds on IPR and to “Value our software; There are companies that can value your software to make an amortization & increase the company value.”

Others were interested in approaches to patentability as a way to enter the market. For instance, “We have to clearly name our target market because our [product] by definition is horizontal to industries (construction, oil, and gas) and technologies (iot, ... sensors, and ML) and that is a limit when we present ourselves and declare the main category we belong to.” Another startup felt that “Understanding IP protection & GRPR compliances will allow us to compete with our product on European and International markets.”

Not all startups wanted to adopt business models based on IPR, with one wishing instead to develop: “1. A better understanding of existing open-source licences, related permissions and limitations, especially regarding linking, distributing, sub-licencing, patent or trademark granting 2. How to build a profitable business around an open-source licence.”

#### 4.7.2. *Innovativeness*

Respondents at the intersection of IP and Innovativeness were interested in the specifics of patenting technologies related to data and AI. One startup expressed that an “important service for our core AI technology is IP protection: so we need mentorship and support on Patent and copyright.” Some companies already had “a good background on IP considerations via patents, but less experiences on IP considerations for data/software” in particular. Understandings of how “patents can be used to protect ML models” were therefore in demand.

#### 4.7.3. *Risk-taking*

The most prominent theme at the intersection of Risk-taking and IP was the protection of IP. One of the startups “did some preliminary investigations on how to protect our industrial secret we wish to keep concealed and it is time to go ahead. We need to invest on the way we communicate.”

Other startups lacked legal skills and were “challenged with a lot of legal questions.”



Two applicants were also concerned about IP in relation to their business model. One startup said: “We face issues negotiating the contracts about data ownership and IPR. We envision to benefit from the training to get better understanding of the space, get ideas on what to do with the data and monetize the data or build new services on top of the data.” Another startup expressed that “Maintaining our code open-source is one of our core values, but we struggle to identify the optimal licence—business model combination for our case.”

#### 4.8. Discussion

Our investigation addresses the needs and objectives expressed by data-centric startups and SMEs who applied to participate in the DMS Accelerator, a publicly funded programme which offers support services related to fundraising, acceleration, data skills, GDPR, promotion, standardization and legal issues. In order to maximize the impact of such offerings by public funders, it is important to understand the individual values, tensions and potential conflicts of interest in the companies who participate in these innovation programmes (Boon and Edler, 2018). Our study analyzed the startups’ written application forms which were submitted to the accelerator, enabling us to evaluate the degree to which their EOs aligned with the European Commission’s objectives in regards to best practices related to data and AI innovation.

We learnt that the main priority areas discussed by startups were related to fundraising, acceleration and data skills. With the exception of data skills, these preferences largely reflect the typical training offerings of commercial accelerators and incubators that aim to generate profit, which differs from the ecosystem-level benefits desired by public funders. Specifically, the present program is funded by the European Commission, whose priority areas such as standardization, IP and GDPR were addressed to a lesser extent by the applicants. This finding reflects an earlier study where we examined the impact the same programme, where we found that services related to standardization and legal skills received less interest from DMS participants (Priestley et al., 2021), underscoring the need to better understand startups’ motivations and find ways to engage them in these services.

Although startups did not demonstrate equal levels of interest towards all the training services that were being encouraged, we learnt that their underlying motivations were generally consistent and reconcilable with the goals of the European Commission. For example, a prominent use of Fundraising was the expansion of their team, thus contributing to regional development through employment. Moreover, fundraising appeared to be the bottleneck whose advancement would most contribute to their innovation activities and validation in European markets. In the Acceleration category, startups also expressed interest in European partnerships and scaling of solutions through business-to-business transactions and data integrations. Technology convergence and cross-sector applications of this kind are similar to the ambitions that public funders seek to encourage through standardization. However, in our sample, a relatively small proportion of startups with these goals requested training in standardization, suggesting that this was a latent need whose relevance was not fully recognized or prioritized at the application stage. This finding is consistent with earlier observations of startups and SMEs being under-represented in standardization activities, even though they are highly impacted by standards and have the competence to contribute towards essential technologies with success rates that match larger stakeholders (Gupta, 2017).

Respondents who explicitly requested help with standardization, IP and GDPR in our study could be roughly divided into two groups. Some of them simply wanted to develop a better insight into how these practices could be beneficial, while others already had perceptive insights into how they would help to scale their business. For example, standardization and GDPR were discussed not only in the contexts of technical and legal compliance, but also as a means of growing social capital in terms of trust and leadership in their industries. It is possible that such incentives vary by industry; for instance those working in healthcare would likely find GDPR more relevant than those in a field such as precision farming. Social values were also implicated in decisions surrounding IPR. Besides the legal protection of inventions, several companies were looking to understand how patents could increase the intangible value of their company in the eyes of investors. These objectives resonate with those expressed by the larger

portion of startups in more popular service categories such as Acceleration and Fundraising. We therefore suggest that a possible way to make the less desired services more appealing to startups is to align them with the startups' existing interests and proclivities, as well as by capitalizing on their receptivity to learning from others.

In addition to observations regarding attitudes towards specific service categories, our findings revealed broader behavioral patterns in regards to the mode of innovation. Specifically, the applicants were predominantly focused on using data and AI technologies to build new products and services, as opposed to improving their internal operations through automation or the adoption of new practices. The conceptual distinction between product innovation and process innovation could therefore be a useful addition to future work, where secondary categorizations of EO may help to obtain more precise insights into the innovation practices of companies. Previous examples of granular frameworks of this kind include the work of Linton (2019), who distinguished between entrepreneurial *processes* and *outcomes*. Similarly to our study, the authors used a qualitative approach to reveal detailed insights into entrepreneurship that would not be detectable through more traditional survey-style evaluations.

In conclusion, our findings contribute insights that can be used to support the administration of publicly funded interventions related to data and AI to startups and SMEs, in addition to highlighting topics of conceptual significance that may be useful to researchers of innovation. For programme managers, we show that although the EOs of startups are broadly aligned with the objectives of public funders, there is still a mismatch between the support services that they request and the specialized interventions that are available to them. It is therefore important to promote the lesser known services by informing about their benefits and showing how these best practices can help to meet the companies' self-perceived needs. For researchers and theorists of corporate innovation, we provide insight into the specific behaviors and attitudes through which data-driven startups and SMEs demonstrate their EOs. In addition to exemplifying how the EO framework can be applied qualitatively in this context, we brought attention to secondary concepts that can inform the methodological design of future studies in this area. A summary of our recommendations to innovation programme managers and researchers is provided in the next section.

#### 4.8.1. Recommendations

Based on our insights into the motivations of startups entering the European data and AI economy through DMS Accelerator, we make the following recommendations:

- *Use case studies and stories* to clarify how specific best practices have been used in industry. Descriptive stories have already been used by the European Commission to present the operational, organizational and economic benefits of data-driven technologies (Cattaneo et al., 2020). We suggest that a similar format could be effective in conveying tacit knowledge related to the value of standardization, IP, GDPR and process innovation. By presenting the experiences of other companies, such stories could appeal to the startups' desire to be inspired by others and to feel part of a community.
- *Show how each practice relates to startups' existing motivations* by presenting:
  - Standardization as a source of insider knowledge, networking opportunities and a means to ensure interoperability between platforms.
  - IP as a way to secure their position in the market and to signal their value to investors.
  - Compliance with GDPR as a way to build trust and leadership.
- We also recommend *for innovation programme managers to utilize their monitoring data and experiences to report on the changing needs and experiences of startups*. This will provide policy-makers and other innovation programmes with an ongoing insight into the current state of the European startup ecosystem, so that interventions can be adapted accordingly.

- Lastly, we recommend that a *distinction between product and process innovation* can offer greater precision for assessing the ways in which data and AI technologies are being assimilated by companies. Such insight can help public funders to distribute resources towards more diverse forms of innovative activity.

#### 4.8.2. Limitations and future work

Our investigation utilized data from startup application forms that had originally been collected for a different purpose. It is therefore possible that the results presented here were partly an artefact of the data gathering process. For instance, asking startups about how they would benefit from the training program naturally stimulated more future-oriented perspectives that were coded under the dimension of Proactiveness. Similarly, an explicit question about how they would use fundraising also meant that more responses were produced in the Fundraising service category. It would be useful to verify these findings using alternative methods such as surveys or interviews that give startups an opportunity to elaborate on their reasons for choosing certain services in favour of others.

The accuracy and validity of our preliminary findings could also be improved through multiple coding rounds and additional analysts. Given the subjective nature of our topic and the large time investment required for manual analysis, future work may benefit from computer-aided text analysis of entrepreneurial dimensions (Short et al., 2010). This offers an opportunity to analyse larger and more representative samples of data. Specifically, one could include rejected applications and consider sector-specific attributes.

The focus of our study on successful applicants may have biased the findings towards companies that were most aligned with the goals of the European Commission. However, even in this select group of startups, the finding that some best practices received disproportionately less attention underscores the need to better promote these interventions.

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**Data Availability Statement.** The data underlying our article cannot be shared publicly because they contain commercially sensitive information. We obtained permission to use the dataset from The Next Web (TNW) through our partnership in Data Market Services (DMS) Accelerator. Controlled access to the dataset may be requested by researchers who want to use the data for academic research purposes. This can be done by emailing the authors (Maria Priestley—[maria.1.priestley@kcl.ac.uk](mailto:maria.1.priestley@kcl.ac.uk)), who will pass on the query for consideration by TNW and DMS coordinators.

**Ethical Standards.** This investigation reuses administrative data that were collected by the Data Market Services Accelerator. Because personal data were not part of our analysis, approval from the ethics committee of King's College London was not required. Our study was done in consultation with the Information Compliance team at King's College London.

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