



Exploring a new incubation model for FinTechs: Regulatory sandboxes

Ahmad Alaassar^{a,b,*}, Anne-Laure Mention^{a,c,d,e}, Tor Helge Aas^b

^a RMIT University, College of Business, Melbourne, Australia

^b University of Agder, Kristiansand, Norway

^c Tampere University, Visiting Scholar, Finland

^d Singapore University of Social Sciences, Blockchain and Fintech Research Fellow, Singapore

^e INESC TEC, Portugal

ARTICLE INFO

Keywords:

Financial technology (FinTech)
Regulatory sandbox
Incubation models
Business incubators
Business accelerators
Activity system framework

ABSTRACT

Research on incubation models indicates that incubators and accelerators are crucial catalysts for the development of start-ups. To facilitate start-ups in financial markets, several regulatory authorities have adopted a new incubation model called a 'regulatory sandbox'. Regulatory sandboxes enable eligible applicants to test their technology-enabled financial solutions for a certain period of time (subject to conditions the regulator imposes). As such, these instruments allow innovation while preventing severe instability in financial markets caused by systemic risk. Despite their importance, management research has devoted little attention to studying how sandboxes operate as a new incubation model. In our abductive study, we adopt the activity system framework and a qualitative analysis approach to investigate the activities of five leading sandboxes and compare them with the activities of other incubation models. The data analysis yielded an activity model with three design elements (achieving membership, participating and detaching) and one design theme (improving connectedness). Thus, sandboxes are characterized by providing regulatory guidance and facilitating access to testing across international jurisdictions, distinguishing them from both generic and specialized incubation models. Our primary contribution to the incubation literature is extending the knowledge of a unique incubation model through a set of theoretical propositions.

1. Introduction

Business incubators (BIs) and accelerators can play a vital role in facilitating start-ups' entrepreneurial activity, enterprises that often have constrained resources and a high failure rate (Peters et al., 2004). Certain industries, including financial markets, energy and pharmaceuticals, face additional barriers to innovation due to regulatory constraints that vary across jurisdictions, inhibiting entrepreneurial firms (Blind, 2012; Hornuf and Schwiendacher, 2017). To overcome such barriers, governments offer sector-specific BIs and accelerators, providing access to resources that significantly lower validation costs and time to market (see Doblinger et al., 2019; Grifantini, 2015; Michael and Pearce, 2009). For instance, the US government founded the National Incubator Initiative of Clean Energy (NIICE) to consolidate the efforts of clean technology (CleanTech) BIs and accelerators through a knowledge exchange platform (DOE, 2018). In financial markets, regulatory authorities have set up several initiatives, including regulatory sandboxes and innovation hubs, to engage and support financial

technology (FinTech) start-ups (ESMA, 2019; UNSGSA et al., 2019). These examples illustrate an increasing focus on supporting sector-specific incubator organizations to foster novelty in regulated sectors. Scholars such as Stayton and Mangematin (2019) hold that individualized investigation of these industries is necessary due to their peculiarities (e.g., regulatory environment), making each relevant for dedicated research. Thus, we investigate regulatory sandboxes as important support instruments for FinTech start-ups in financial markets, following recent contributions investigating this sector (Gazel and Schwiendacher, 2020; Haddad and Hornuf, 2018; Laidroo and Avarmaa, 2019).

Using digital technologies such as artificial intelligence, blockchain and big data analytics, FinTech start-ups develop, test and deliver a wide range of innovative financial services (FS) like digital payment solutions, securing them new opportunities and disrupting the course of traditional banking (Lee and Shin, 2018). However, FinTech start-ups face barriers to development due to the high cost of compliance and a lack of regulatory knowledge (Arner et al., 2015; Haddad and Hornuf,

* Corresponding author. Building 80, College of Business, RMIT University, Melbourne VIC, 3000, Australia.

E-mail addresses: ahmad.s.m.alaassar@rmit.edu.au (A. Alaassar), anne-laure.mention@rmit.edu.au (A.-L. Mention).

<https://doi.org/10.1016/j.technovation.2021.102237>

Received 24 May 2019; Received in revised form 8 January 2021; Accepted 5 February 2021

Available online 13 February 2021

0166-4972/© 2021 The Author(s).

Published by Elsevier Ltd.

This is an open access article under the CC BY-NC-ND license

(<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

2018; IOSCO, 2017; UNSGSA et al., 2019), potentially leading to firm failure and disruption in financial markets (Pai, 2017). In response, regulatory authorities from numerous countries including the US, the UK, Singapore and Australia have taken an active stance to find appropriate regulatory solutions that stimulate innovation, improve market competition and ensure financial market stability (Arner et al., 2016; Fan, 2017; Jenik and Lauer, 2017). One of the first, in 2016, the UK's Financial Conduct Authority (FCA) established a regulatory sandbox to achieve these objectives (Fan, 2017; Zetzsche et al., 2017). These are environments free from legal consequences in which FinTech firms can test and validate their business models without draining their resources by attempting to obtain traditional financial licenses (Teigland et al., 2018). Following the UK's lead, other governments have hurried to design and establish sandboxes. On a global basis, recent reports indicate that over 50 jurisdictions have either announced or already operate a sandbox (see UNSGSA et al., 2019 for an overview).

With the rapid increase in the number of FinTech market participants, regulators face challenges in designing and operating regulatory instruments in a context conventionally characterized by command-and-control regulatory approaches (Mangano, 2018). Creating and operating sandboxes is crucial from the perspective of regulators, given their role in stimulating financial innovations and reducing disruptions in financial markets. That said, there remains a lack of academic research shedding empirical light on how regulatory sandboxes operate from a management perspective, with most research addressing exclusively legal issues (Arner et al., 2017; Bromberg et al., 2017; Zetzsche et al., 2017). We fill this gap by exploring the activities of this novel support instrument to establish a knowledge-based foundation that will foster advancements in regulatory sandboxes. An activity refers to involved actors' engagement to achieve an overarching objective (Zott and Amit, 2010). When adapted to the incubation setting, this represents activities such as training conducted during selection, business support and mediation (Bergek and Norrman, 2008). Following Pauwels et al.'s (2016) investigation of accelerators, we explore activities instead of other dimensions as a foundation that must precede future investigations dealing with performance.

Viewed broadly, BIs, accelerators and regulatory sandboxes all reduce the high failure rates associated with new venture creation (Aerts et al., 2007). However, BIs provide a wider range of services to support firm entry into different industries than sandboxes, which have thus far focused on FS in selected categories like banking, insurance and investment management (ESMA, 2019). In addition, regulatory sandboxes have certain distinctive characteristics: the prominent role of regulators, being led by public institutions, providing licensing exemptions and regulatory support services that pilot novel innovations without systemic risk (Arner et al., 2017; Magnuson, 2018; UNSGSA et al., 2019; Zetzsche et al., 2017). We thus argue that, due to the specific characteristics of regulatory sandboxes, one cannot blithely assume that the knowledge from the incubation literature necessarily applies to regulatory sandboxes.

The study aims, by exploring and identifying the activities that characterize the incubation model of regulatory sandboxes, to find out 'How are the activities of regulatory sandboxes different compared with the activities of BIs and accelerators?' To answer this research question (RQ), we first analyze the secondary data of archival documents (e.g., regulatory guides, consultation papers) from five regulatory sandboxes in leading financial centres using the activity system framework (Zott and Amit, 2010). We then discuss the differences of sandboxes in relation to the incubation literature, guided by the incubation model activities of generic (Bergek and Norrman, 2008) and specialized (Schwartz and Hornych, 2008) BIs and accelerators. We thus contribute to both the incubation literature and to practice by exploring a new incubation model that has gained the attention of stakeholders in the FinTech space. Broadly, we contribute to the emerging FinTech literature, which remains insufficiently theorized and lacks the needed scholarly and practitioner attention (Gazel and Schwienbacher, 2020;

Gimpel et al., 2018; Puschmann, 2017).

The remainder of the paper is structured as follows: we begin with a theoretical background reviewing the literature on incubation models and present the research framework. We outline the research process in the methods section and explore the empirical results from the cases in the findings section. The discussion section offers propositions and addresses theoretical and practical implications. We close with concluding remarks and future research avenues.

2. Theoretical background

In this section, we first offer an overview of the characteristics of FinTech ventures. We then review incubator configuration studies that focus on the activities of BIs and accelerators, followed by a review of regulatory sandboxes and their relevance for FinTech start-ups. We further justify why this study is needed by conceptualizing the case of regulatory sandboxes in contrast to BIs and accelerators. Finally, we present the activity system framework guiding our empirical investigation.

2.1. Characteristics of FinTechs

FinTech has been broadly defined as 'technology-enabled innovation in financial services that could result in new business models, applications, processes or products with an associated material effect on the provision of financial services' (FSB, 2017, p. 7). The emergence of FinTech is traceable to the aftermath of the 2008–2009 financial crisis; it was led by start-ups and technology firms delivering FS using digital technologies and data-driven solutions (Arner et al., 2017; Jenik and Lauer, 2017; Lee and Shin, 2018). The FinTech movement is characterized by digital infrastructures and interfaces, unlike traditional financial institutions that still operate legacy IT systems that, in some cases, are more than 38 years old (CBInsights, 2018; Gozman et al., 2018). That said, incumbents benefit from access to large customer bases, the ability to predict changes in markets based on extensive industry experience and knowledge of banking regulations; by contrast, FinTech newcomers have the advantage of building efficient systems from the beginning (Philippon, 2016).

We focus on FinTech start-ups that, in addition to being constrained in terms of resources, may lack sufficient knowledge of the relevant regulatory frameworks (e.g., Arner et al., 2015; IOSCO, 2017; Peters et al., 2004). FinTech start-ups target specific market segments by offering customized services based on technologically innovative solutions (Gozman et al., 2018). Haddad and Hornuf (2018) demonstrate that determinants like technological infrastructure, talent pool, venture capital and supportive regulatory initiatives have positive impacts on the formation of FinTech start-ups.

The lack of legacy systems and relatively lower level of organizational complexity enable FinTech start-ups to be more responsive and radically innovate FS (Hornuf et al., 2020). However, the novel application of enabling technologies to deliver FS presents compliance-specific challenges that are different than those incumbents face. For instance, activities on crowdfunding platforms (i.e., getting funds from the crowd based on big data analytics rather than long-term relationships, like in the banking sector) require different banking regulations to be enforced (Navaretti et al., 2017). Taken together, these factors indicate an urgent need to support FinTech start-ups in financial markets; however, there is scarce scientific research on how support instruments foster FinTech novelties.

2.2. Incubation models

An incubation model is a support institution that enables the survival and development of new ventures through the provision of entrepreneurial support services (Pauwels et al., 2016). Such support services (i.e., activities) are further identified as one of the main components in

incubation research capturing incubators' operations (Baraldi and Havenvid, 2016). However, the incubation literature (e.g., Bergek and Norrman, 2008) denotes that identifying how and in what ways incubator support activities are provided has received little academic attention.

2.2.1. Business incubators

In a generic sense, technology BIs represent support organizations like accelerators, science parks, innovation offices and industrial parks (Bøllingtoft, 2012; Cohen, 2013; Löfsten and Lindelöf, 2002; Mian et al., 2016). BIs first became popular in the 1980s; their offerings have been evolving ever since (Bruneel et al., 2012). According to Hackett and Dilts (2004, p. 57), a BI is a 'shared office-space facility that seeks to provide its incubatees with a strategic, value-adding intervention system of monitoring and business assistance. This system controls and links resources with the objective of facilitating the successful new venture development of the incubatees while simultaneously containing the cost of their potential failure'. More precisely, BIs facilitate entrepreneurial ventures by providing business support services, access to physical facilities and networking opportunities (Mian et al., 2016).

Campbell et al. (1985) made the first attempt to conceptualize how incubators operate to illuminate their internal activities. They delineate four such activities: identification of business needs, selection and monitoring, access to capital investment and network access. Through these activities, incubation models create value for their tenants (Campbell et al., 1985). Bergek and Norrman (2008) examine how incubator practices differ from one another and propose an incubator model framework including selection, business support and mediation as the most distinctive activities. Selection concerns the assessment criteria employed when evaluating a start-up's entry into the incubator. Business support refers to services like start-up development training, mentorship, legal and patent services, financial services and marketing and advertising services provided during the incubation process. Mediation refers tenants' ability to access external resources to facilitate development, especially when the incubator lacks the required expertise (Bergek and Norrman, 2008; Hausberg and Korreck, 2018).

2.2.3. Regulatory sandboxes: A new incubation model for FinTech start-ups

Regulatory sandboxes grant time-limited licensing exemptions to eligible FinTechs to test their solutions, as subject to imposed regulatory conditions in each jurisdiction (Arner et al., 2016; Zetzsche et al., 2017). These instruments are initiated by public-based institutions with a regulatory or monetary function (Bromberg et al., 2017) and commonly established following public consultation processes in which ecosystem stakeholders are engaged to help shape sandbox activities (CCAF, 2018). Fan (2017) stresses that sandboxes do not eliminate the risk of business failure – a determinant of innovation – rather, they reduce the consequences of testing on consumers and financial market stability. Hence, sandboxes reduce systemic risk¹ (Magnuson, 2018).

2.2.2. Business accelerators

Business accelerators are commonly characterized as short-term and cohort-based programs (Cohen, 2013; Hausberg and Korreck, 2018). In a study exploring accelerators, Pauwels et al. (2016) argue that accelerators have four distinct features: 1) not being designed for the long-term provision of support services and physical facilities, 2) generally offering pre-seed funding in return for ownership shares, 3) geared toward angel investors rather than venture capitalists and 4)

providing intensive short-term training and business development support to prepare start-ups for investment.

To explore the incubation model of accelerators, Pauwels et al. (2016) adopt the activity system framework to identify design elements that characterize the activities of accelerators on the one hand and design themes that emerge from particular types of accelerators on the other. The design elements include 1) a 'program package' that consists of offered services (mentoring, training, investment opportunities, physical facilities); 2) a 'strategic focus' that highlights whether accelerators are focused on a specific industry or geographical location; 3) a 'selection process' that represents screening activities like in-person presentations and third-party screening services; 4) a 'funding structure' that considers revenue streams supporting the accelerator operation, which can be private, public or self-generated and 5) 'alumni relations', which represent networking activities with graduated participants and a post-accelerator program. They also identified three distinct themes that characterize accelerator models: the ecosystem builder, the deal-flow maker and the welfare stimulator (Pauwels et al., 2016).

2.2.4. Complementing existing knowledge: regulatory sandboxes vs incubation models?

While incubation studies have reported positive implications of BIs and accelerators for start-ups in a variety of sectors, it is less clear whether emerging FinTech start-ups can benefit from incubation models in the same way. This is due to generic and diffuse investigations that either overlook specialized incubators, study a broad sample of incubation models and start-ups or capture a time period irrelevant to the FinTech phenomenon. For instance, Aerts et al.'s (2007) investigation of European incubators' screening practices showed that 44% (sample N = 107) of the incubators specialized in the financial sector, but their sample was collected in 2003, long before the rise of FinTechs. Among recent studies confirming that incubation models significantly lower FinTechs' risk of failure, Gazel and Schwiendbacher (2020) examine a sample of BIs and accelerators; however, they do so without explicitly targeting the impact of support activities. Regarding accelerators, while Pauwels et al. (2016) indeed study one FinTech accelerator, their findings are combined with other sector-specific accelerators, making it difficult to distinguish how the FinTech accelerator operates. That said, it is important to acknowledge that prior investigations, although not specific to incubation activities conducted to enable FinTech start-ups, do provide relevant insights for our study, including common activities. However, we argue that the differences in this relatively young context (including high compliance costs and regulatory challenges) intertwined with regulators' and FinTechs' characteristics call for different types of incubation activities to support innovation. This is in line with previous arguments in incubation research promoting incubator specialization and providing sector-specific support services (Grimaldi and Grandi, 2005; Schwartz and Hornych, 2008; Vanderstraeten and Matthyssens, 2012). Some of the advantages of sector-specific BIs that Schwartz and Hornych (2008) highlight are 1) specialized facilities, 2) sector-specific know-how and networks, 3) a collaborative co-working environment and 4) intangible image effects.

Regarding the literature on sandboxes, we deduce that certain characteristics distinguish regulatory sandboxes from existing BIs and accelerators: regulatory authorities' uncommon intervention of supporting innovation, periodic licensing exemptions allowing FinTech novelty-testing and regulators' roles in providing knowledge about regulatory frameworks. Thus, on the one hand, due to these specific characteristics, evidence on incubation activities that is not industry-specific may not be entirely transferable to the study of regulatory sandboxes. On the other hand, sector-specific knowledge falls short in terms of investigating the unique incubation activities of FinTech start-ups, with the exception of some studies investigating how FinTechs benefit from corporate BIs or accelerators in terms of access to customer base, knowledge of banking regulations and access to financial licenses

¹ According to Magnuson (2018), scholarship on financial stability has traditionally assumed that large financial institutions are the primary source of systemic risk and threat to the overall economy. In this study, we adopt Magnuson's view, arguing that smaller financial actors like FinTechs enabled by certain abilities (e.g., digital technologies) may constitute systemic risk issues greater than established financial institutions.

(e.g., Hornuf et al., 2020). While these benefits can certainly encourage FinTechs to cooperate with or even be acquired by incumbents, they disadvantage other start-ups and limit market competition, as newcomers may not find support instruments that are independent from incumbents. It is thus crucial to illuminate the role of regulatory sandboxes in promoting start-ups in financial markets. On this basis, we investigate the incubation activities of sandboxes and provide an evidence-based comparison of the activities of sandboxes to both generic and sector-specific BIs and accelerators. To guide this comparison, we use the generic incubation activities of selection, business support and mediation (Bergek and Norrman, 2008) and the sector-specific incubation activities of specialized facilities and sector-specific know-how and networks (Schwartz and Hornyk, 2008).

2.3. The activity system: A framework to study incubation activities

Like Pauwels et al. (2016), we argue that the activity system model Zott and Amit (2010) suggest is – through identifying its main design elements and themes – an appropriate framework to study how incubation models operate and differ from other existing models. Introduced to assist firms in designing their business models, the framework encourages the focal organization to adopt a holistic approach rather than partial optimization when designing the system of activities required to create, deliver and capture value by the focal organization and its stakeholders. It also suggests how the focal organization is embedded in its ecosystem through the structure of interactions with network actors (Zott and Amit, 2010).

The activity theory championed by Vygotsky (1978) attempts to explain the connections among individual actions in society; here, any activity includes human action and interaction toward achieving a specific goal (Zott and Amit, 2010). From that starting point, the authors conceptualize organizational activity ‘as the engagement of human, physical and/or capital resources of any party to the business model (the focal organization, end customers, etc.) to serve a specific purpose toward the fulfilment of the overall objective’ (Zott and Amit, 2010, p. 217).

The activity system framework is divided into two design parameters (see Table 1). First, design elements describe the architecture of an activity system featuring activities carried out to create value, how these activities are connected and by whom they are performed. The second parameter represents design themes that describe the sources of value creation in the activity system, distinguished by the extent to which an activity system is coordinated and connected through certain themes like novelty, lock-in, complementarities and efficiency. Apple’s introduction of iPod and iTunes is a good example of a design theme reflecting novelty in content, structure and governance (Zott and Amit, 2010). While both design parameters fundamentally describe activities, the design elements are concerned with how value-adding activities are conducted, whereas design themes focus on identifying the key sources of value creation.

We adapt the activity system framework to our study to facilitate data analysis when exploring the design parameters that characterize regulatory sandboxes and subsequently understand how value is created

Table 1
An activity system design framework (adapted from Zott and Amit, 2010).

Design Elements	
Content	What activities should be performed?
Structure	How should they be linked and sequenced?
Governance	Who should perform them, and where?
Design Themes	
Novelty	Adopt innovative content, structure or governance
Lock-in	Build in elements to retain stakeholders like sandbox participants
Complementarities	Bundle activities to generate more value
Efficiency	Reorganize activities to reduce transaction costs

and captured for sandboxes as focal organizations.

3. Method

We employ a qualitative research design to identify the activities that characterize sandboxes and to address the RQ ‘How are the activities of regulatory sandboxes different compared with the activities of BIs and accelerators?’; we use an abductive approach to explore and develop new explanations through systematic combining (Dubois and Gadde, 2002). Systematic combining facilitates the process of alternating between different data sources, theoretical frameworks and existing knowledge to explain the phenomenon under study (Dubois and Gadde, 2002). We chose this approach because the regulatory sandbox model is in a nascent stage with limited academic evidence, necessitating an exploration of the empirical phenomenon, even while being informed about prior research. Our data collection included secondary data comprising archival documents retrieved from five leading regulatory sandbox webpages. This type of data has proven valuable in several studies of related phenomena in different sectors (e.g., Wang and Hajli, 2017), including FinTech (e.g., Gozman and Willcocks, 2019). Additionally, archival research provides accessibility to enough online documents from a range of sources to enable analysis of the phenomenon in multiple locations.

3.1. Sampling

We executed case selection using the following parameters: first, we focused on public-led regulatory sandboxes because only regulatory and monetary authorities have the power to provide licensing exemptions, which is an integral characteristic of a regulatory sandbox. Second, given the novelty of the sandbox model – with only six founded in 2016 (Zetzsche et al., 2017) – we included only regulatory sandboxes that were operating by 2016 to capture information-rich cases featuring the most highly developed sandboxes.² This is particularly important because sandboxes serve as a testing arena for both regulators and innovators, enabling knowledge exchange and dissemination in the form of reports (FCA, 2017). Finally, the regulatory sandboxes had to have an adequate number of documents published online to enable our investigation of the activities they conducted.

Using the above sampling procedure, five of the six sandboxes established in 2016 qualified for selection; we excluded Bank Negara Malaysia due to a lack of online documents. Although limited in size, this sample represents the only active cases (operational with use cases) that provide sufficient variation and meaning to illuminate the studied incubation activities of sandboxes, thus ensuring an adequate qualitative sample (Cleary et al., 2014). Besides, a recent survey of innovation facilitators covering 28 countries reported that sandboxes were the most commonly adopted instrument by regulators worldwide (Jenik and Sharmista, 2019),³ indicating that sandboxes cover most of the world’s regulator-led initiatives in the field.

² As of March 2018, 17 regulatory sandboxes were operating in the UK, Hong Kong, Malaysia, Singapore, Abu Dhabi, Australia, Mauritius, the Netherlands, Indonesia, Brunei Darussalam, Canada, Thailand, Bahrain, Switzerland, Saudi Arabia, Denmark and the US state of Arizona (Ringe and Ruof, 2018). The majority of established regulatory sandboxes had either not received applicants or had no graduated participants at the time of data collection (October 2018–February 2019).

³ Innovation facilitators overseen by regulators included (by percentage): regulatory sandboxes (35%), innovation hubs (26%), internal innovation facilitators (15%), accelerators (13%) and other facilitation (11%). The data presented are from a survey by the Consultative Group to Assist the Poor (CGAP) and the World Bank Group (Jenik and Sharmista, 2019).

3.2. Data collection

The final sample consisted of 459 pages of secondary data from regulatory sandboxes in Australia, Hong Kong, Singapore, the United Arab Emirates (UAE) and the UK and was collected between October 2018 and February 2019. As of April 2019, 204 FinTech firms (including start-ups, licensed financial institutions and technology providers) have been granted access to these sandboxes since their establishment in 2016. As an example of the proportion of start-ups, 80% of the first two cohorts in the FCA sandbox were FinTech start-ups (FCA, 2017). Table 2 outlines the key characteristics of the selected cases; their timeline highlights are presented in Fig. 1. In total, we retrieved 39 archival documents (see Appendix 1 for a full list) – including regulatory guides, consultation papers, reports, information sheets and press releases – to explore sandboxes' design elements and themes.

3.3. Data analysis

We followed the Gioia methodology to achieve a qualitatively rigorous data analysis process, extracting aggregated dimensions from 1st-order coding and 2nd-order themes (Gioia et al., 2013). While this method of analysis typically follows an inductive approach, we rely on an abductive approach that informs us about prior research and enables our use of a theoretical framework to guide the analysis (Dubois and Gadde, 2002, 2014). Gioia et al. (2013, p. 21) support this approach: '[upon] consulting the literature, the research process might be viewed as transitioning from "inductive" to a form of "abductive" research'. Similarly, our process of systematic combining comprised a shifting back and forth between the secondary data, the activity system framework and the relevant literature.

Guided by the activity system framework (Zott and Amit, 2010), the coding process commenced with an initial coding scheme to explore categories describing the activities of design elements or design themes, as mentioned in Table 1. Like Zott and Amit (2010), we assume the design elements and themes to be independent, though they could be interdependent. Despite the coding process being highly iterative, design elements, including what activities create value, how activities are connected and who performs these activities, were identifiable in the earlier stages of coding. In contrast, we created design theme categories toward the end of this round of analysis, as we depended upon first achieving an overview of established design element activities. This enabled us to consider whether the created categories could instead be related to design themes representing the activity system's main value creation drivers, characterized by novelty, lock-in, complementarities or efficiency. In the first round of coding, we labelled categories with terms based on phrases from analyzed documents. In the second round of coding, we created abstract themes that described activities of design elements and themes. Finally, we generated aggregated dimensions representing the design elements and themes of regulatory sandboxes based on patterns established in the previous round. We used NVivo to facilitate the analytical procedure (Gaur and Kumar, 2018). Fig. 2 outlines the data structure (how we processed the raw data into codes, themes and aggregated dimensions).

Table 2
Descriptive data of selected sandboxes (compiled by the authors).

Jurisdiction	Launch	Approach	Exemptions granted	Duration of testing	Number of docs per sandbox
Australian Securities and Investments Commission (ASIC)	Dec. 2016	Rolling basis	6	12 months	9
Hong Kong Monetary Authority (HKMA)	Sept. 2016	N/A	46	No maximum time specified	8
Monetary Authority of Singapore (MAS)	Nov. 2016	Rolling basis	8	Upon agreement	4
Abu Dhabi Global Market (ADGM)	Nov. 2016	Cohort-based	26 (3rd cohort)	24 months	12
UK Financial Conduct Authority (FCA)	Apr. 2016	Cohort-based	118 (5th cohort)	3–6 months	6

4. Findings

Here, we report the key findings from our archival document analysis to explore the activities that characterize regulatory sandboxes, in which we captured four aggregated dimensions that represented their design elements and themes (Fig. 2). Using regulatory sandboxes as the unit of analysis, the findings reflect regulators' perspectives, including their feedback and observations about FinTechs. This section remains at the level of empirical evidence by introducing the aggregated dimensions of regulatory sandboxes, with the subsequent section discussing these findings in relation to the activity system framework and incubation literature.

4.1. Design elements: How value-adding activities are conducted

4.1.1. Achieving membership

Our findings suggest that achieving membership consisted of early-stage activities through which regulatory sandbox staff interacted with potential participants to check eligibility, support applicants and evaluate and grant exemption requests.

Checking the eligibility of those interested in FinTech solutions is among the first activities that most regulators conduct as a condition of offering further support and to establish eligibility for a formal application. If applicants meet the relevant criteria, a case officer is assigned to provide informal assistance as the start-up attempts to achieve membership. The sandbox in Hong Kong uses a different approach; here, interested parties can file their applications directly. In a departure from other sandbox activities, the Australian Securities and Investments Commission (ASIC) has an automated licensing exemption for limited services, which allows eligible firms to rely on relief without having to complete a formal application. This approach is highlighted in ASIC's RG257 document: 'You [the market participant] do not need to apply to obtain the benefit of the fintech licensing exemption. If you meet the eligibility requirements and follow the conditions set out in the relevant instrument, you are legally entitled to rely on the exemption for 12 months' (ASIC, 2017, p. 14). However, ASIC does require applicants to send a written notice and provide information about the business model and the background of the individuals involved (ASIC, 2017). Although regulators have different requirements, the eligibility criteria generally require applicants to 1) provide a product or service that fits into the FS industry, 2) offer an innovation that is either unique or solves an existing problem more effectively, 3) benefit consumers, 4) demonstrate a need for licensing relief and 5) show individual and firm readiness.

In general, most regulators encourage all types of FinTech firms to apply to the sandbox, even if they already possess a financial license. For example, the first two cohorts the FCA hosted consisted of approximately 80% start-ups, 10% small- and medium-sized enterprises (SMEs) and 10% large firms, including HSBC and Lloyds Banking Group (FCA, 2017). By contrast, to be eligible for the financial exemption ASIC provides, participants may not already hold an Australian financial license (ASIC, 2017c). The Hong Kong Monetary Authority (HKMA) began with the opposite approach – when it was established, only incumbents were eligible to access it, and required that technology firms, including new businesses, collaborate with financial institutions to enter the sandbox (HKMA, 2016). However, one year after its launch, the HKMA (2017) announced multiple initiatives to enhance its sandbox to which FinTech

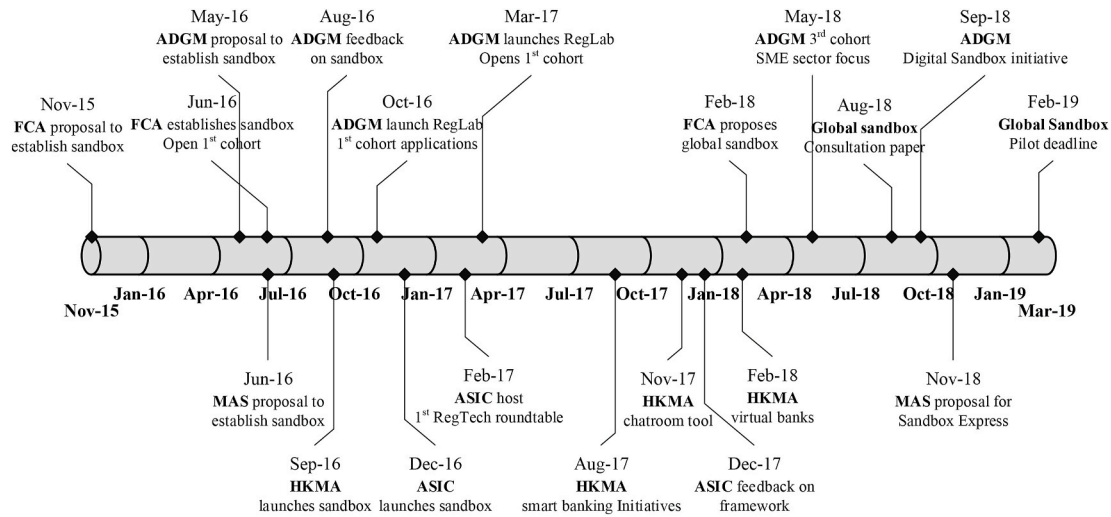


Fig. 1. Timeline of regulatory sandboxes (compiled by the authors using secondary data from regulators' online content).

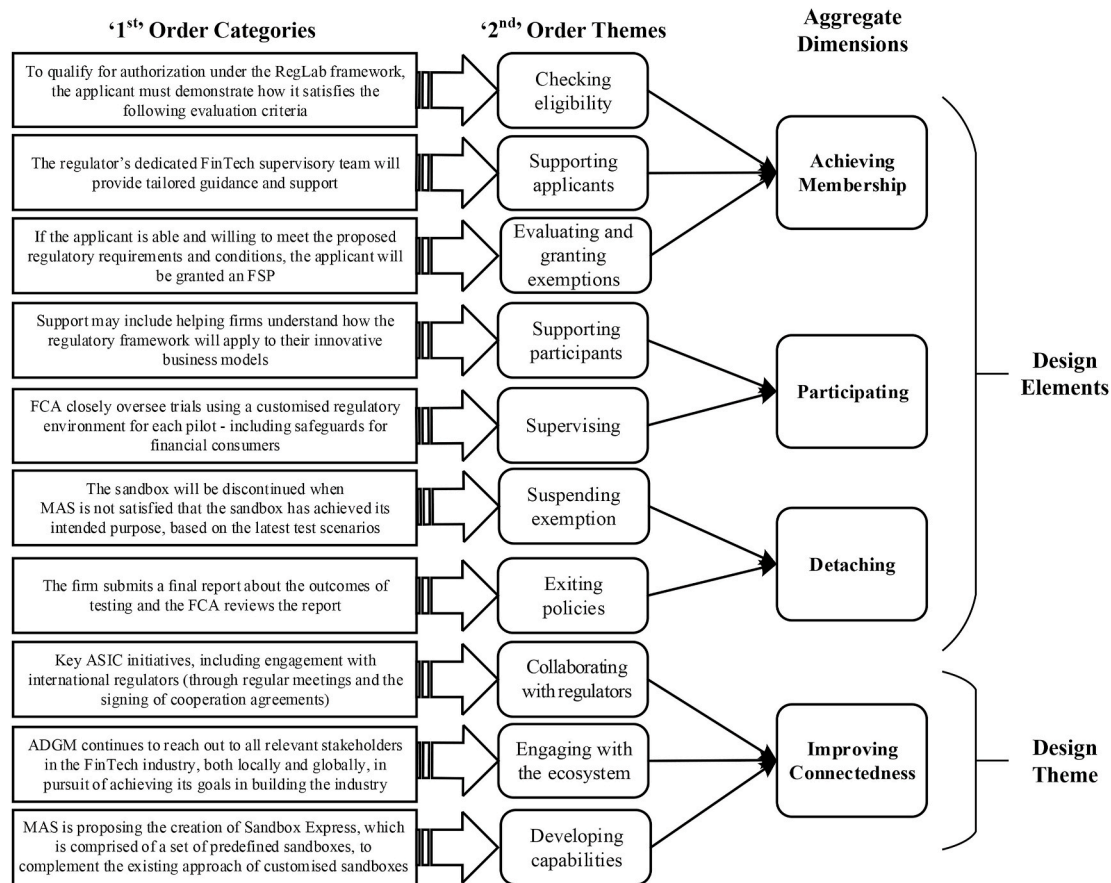


Fig. 2. Activities of regulatory sandboxes (compiled by the authors).

start-ups were permitted access.

Supporting applicants is the next activity we identified in the regulatory sandboxes we assessed. Regulators describe this support as informal guidance provided through an assigned case officer to help applicants navigate the regulatory framework. During this activity, case officers also discuss any compliance issues that arise and may waive or modify the regulatory boundaries to be applied when testing in the sandbox (Abu Dhabi Global Market [ADGM], 2016). For example, the Monetary Authority of Singapore (MAS) reports that participants receive

their first response within 21 days after submission. At this point, regulators and innovators exchange knowledge about the regulatory system and business model. This exchange is made possible through the tailoring approach, which begins early in the incubation model and continues through the completion of an innovator's participation in the sandbox (MAS, 2016). Due to the uncertain nature of expected testing, which may necessitate modifying the sandbox parameters, the tailoring approach also reserves the regulator's right to impose additional requirements (FCA, 2017):

The Regulator will work with the applicant to determine the specific regulatory requirements and conditions (including test parameters and control boundaries) to be applied to the FinTech solution in question. The applicant will then assess if it is able to meet these requirements.... If the applicant is able and willing to meet the proposed regulatory requirements and conditions, the applicant will be granted an FSP [financial services permission] to carry on the Regulated Activity (ADGM, 2016, p. 8, p. 8).

Evaluating and granting exemptions is the final activity before participants can formally commence testing in the sandbox. Through previous interactions with FinTech service providers, regulators would already have collected the required documentation and could thus begin assessing applicants against a set of authorization requirements (such as testing plans with defined testing scenarios and outcomes) accompanied by risk mitigation and exit strategies (FCA, 2015): 'sufficient safeguards are put in place to mitigate potential harm during and after testing' (FCA, 2017, p. 5). Evaluation times were not reported due to the complexity of assessment (MAS, 2016). Examples of boundary conditions are number of clients, transaction amounts, testing periods and additional limitations specific to each regulatory framework (ADGM, 2016b). Finally, MAS (2016) indicates that applicants may also be rejected if they fail to meet sandbox objectives or assessment criteria.

4.1.2. Participating

Our findings further reveal that, while FinTechs were participating, regulators generally engaged in supervisory activities to ensure that participants operated within the set boundary conditions. However, some regulators do provide supporting activities in the form of regulatory guidance and support services to assist sandbox participants during the enrolment period (ADGM, 2016b; ASIC, 2017c; FCA, 2015). For example, the FCA uses case officers to provide guidance and support during the testing period to help innovators understand how regulatory requirements apply in practice (FCA, 2015):

Each firm's case officer works with them [sandbox participants] to develop a test and facilitates engagement with subject matter experts from across the FCA. Direct feedback from [participating] firms ... indicates that this aspect of the sandbox programme is valuable in helping them to understand how the regulatory framework applies to them, accelerating their route to market and reducing expenditure on external regulatory consultants (FCA, 2017, p. 5).

Other regulators provide additional support services. ADGM notes that sandbox participants can access physical facilities: 'FinTech Participants can hold regular showcases and progress updates on their FinTech solutions to their target group of investors and clients. FinTech Participants may also make use of the auditorium facility in the ADGM Building (subject to availability) to conduct these presentations' (ADGM, 2016a, p. 7). Additionally, ADGM arranges workshops and seminars to allow FinTech participants to present their services to a variety of stakeholders (ADGM, 2016a).

Supervisory activities reflect the observational role of regulators, who employ monitoring activities to ensure that sandbox participants follow regulatory frameworks. For instance, regulators may engage with participants to ensure that testing remains within the initially established regulatory boundaries and conditions (ADGM, 2016b). Using supervisory technology like RegTech (i.e., enabling technology that enhances regulatory processes), regulators can supervise testing activities in real time (ADGM, 2018). Additionally, regulators reserve the right to redefine the testing environment's boundary conditions based on observed risks, which may vary with external factors (MAS, 2016).

4.1.3. Detaching

Our findings suggest that detaching begins toward the end of exemption periods, and that certain policies apply. Exemption periods vary from three months to two years. In general, sandboxes allow participants to either extend validity for further testing, complete testing and apply for a full-fledged license or elect not to proceed upon

completion of the exemption period. Additionally, MAS reports that participants can lose access if they fail to comply with the boundary conditions or mitigate risk exposure. For example, MAS may terminate testing if 'a flaw has been discovered in the financial service under experimentation where the risks posed to customers or the financial system outweigh the benefits of the financial service under experimentation, and the sandbox entity acknowledges that the flaw cannot be resolved within the duration of the sandbox' (MAS, 2016, p. 7). Optimally, regulators want sandbox participants to apply for financial licenses prior to completion in order to continue operating immediately after exit and subsequently enable competition in the real-world FS market (ASIC, 2017). Further, our findings reveal that regulators exercise a restricted extension policy and demand that participants terminate operation at the end of validity periods unless an extension or financial license is granted (ASIC, 2017): '... the validity period of the authorisation granted ... may be extended in exceptional circumstances only, determined at the Regulator's discretion on a case-by-case basis' (ADGM, 2016b, p. 6). Finally, as part of their exit policies, regulators require testing firms to submit a completion report summarizing the results they achieved and outlining further steps (FCA, 2015).

4.2. Design theme: key sources of value creation

4.2.1. Improving connectedness

Since the introduction of sandboxes in 2016, most regulatory authorities have followed in the FCA's footsteps, adopting comparable activities with the mission of promoting market competition and innovation in the FS industry. However, our findings indicate that dominant value creation drivers have emerged from regulators with the objective of improving connectedness in FinTech ecosystems.

Collaborating with regulators through cross-border cooperation agreements is carried out not only to enable knowledge exchange among regulators but also to facilitate testing across international jurisdictions and allow foreign FinTech firms to access domestic FS markets. For example, the FCA, ADGM and ASIC have all reported signing agreements with regulators across international jurisdictions:

These [cross-border cooperation] agreements establish a framework for information sharing relating to innovation in financial services, including emerging market trends and regulatory issues arising from the growth in innovation. A number of these agreements also enable ASIC to refer Australian fintech businesses to other regulators' fintech assistance programs-and vice versa. (ASIC, 2107a, p. 10).

Along these lines, in February 2018, the FCA initiated a proposal to establish a Global Sandbox. The rationale was to create a community of regulators, promote collaboration and knowledge exchange among regulators and offer FinTech firms opportunities for testing across international jurisdictions, reducing their time to overseas markets. Shortly afterward, the Global Financial Innovation Network (GFIN, 2018) was established by 11 jurisdictions, including ADGM, ASIC, FCA, HKMA and MAS. As of February 2019, 25 regulatory jurisdictions and four observing organizations were part of the GFIN network (FCA, 2019).

Engaging with the ecosystem is another activity regulators have adopted to interact with innovators and learn from collaborations with external stakeholders; however, the extent of interaction varies from one jurisdiction to another. In some cases, like Singapore, these interactions have supported regulators' efforts to set up a new model: 'Through engagements with players in the FinTech ecosystem, MAS has identified certain regulated activities where pre-defined sandboxes could be reasonably constructed' (MAS, 2018, p. 4). Although the tailoring approach regulators commonly adopt provides opportunities to promote testing and validating solutions, regulators in Singapore emphasize that this approach increases the time it takes to process applicants into the sandbox (MAS, 2018). Thus, MAS (2018) proposed eliminating the tailoring approach for certain types of FinTech firms – including insurance brokerage, recognized market operators and remittance – through

the Sandbox Express. This initiative streamlined achieving membership by creating pre-defined sandboxes: 'The current [sandbox] approach ... requires an extensive review of each application as each sandbox is customised. . . . We have learned along the way that for certain types of regulated activity, the risks can potentially be well managed within certain specific boundaries' (MAS, 2018, p. 4).

Developing capabilities is another activity that regulators adopt to enhance support services and the overall incubation model of their regulatory sandboxes. For instance, the ADGM announced its Digital Sandbox after observing the challenges FinTech newcomers faced (e.g., access to data and international markets) and experiencing the challenge of integrating innovative FinTech solutions into incumbents' legacy systems (ADGM, 2018). On this basis, the Digital Sandbox was established to enable sandbox participants to connect with local and non-local financial institutions to digitally test their solutions in a collaborative environment using synthetic data hosted on cloud-based servers. Through this regulated collaborative space, regulators at ADGM (2018) postulate cost-efficiency and scalability benefits to both sandbox participants and traditional financial institutions.

5. Discussion and implications

An existing stream of incubation research has identified how incubation activities vary between different incubation models like accelerators (e.g., Pauwels et al., 2016) and technological BIs (e.g., Rubini et al., 2015). We extend this research stream by providing systematic empirical evidence on how the nascent sector-specific incubation model of regulatory sandboxes operates and is distinct from other incubation models. Specifically, we apply the activity system framework (Zott and Amit, 2010) to explore the activities of sandbox models. We then compare sandbox activities with generic and specialized incubation models (Bergek and Norman, 2008; Schwartz and Hornych, 2008). In doing so, academics can gain insights into how incubation models may require different designs in specific industries to promote innovation, thereby depicting the limitations of transferability and the need for dedicated research. Moreover, regulators currently operating or considering setting up sandboxes can benefit from our proposed findings to enhance or design appropriate activities for sandbox participants. FinTech start-ups can also determine whether the support services offered in sandboxes meet their needs. Given the exploratory nature of this study, we derive theoretical propositions as conclusions from the discussed findings to help drive future research. Further, we suggest both theoretical and practical implications for different stakeholders.

5.1. Activities characterizing the incubation model of regulatory sandboxes

We identify various activities that characterize regulatory sandboxes: proactively protecting financial systems, tailoring testing environments, granting exemptions, providing regulatory guidance and using a risk-based approach to evaluate FinTech participants. Additionally, value creation drivers that promote access to international jurisdictions, seamless entry to pre-defined sandboxes and collaboration with financial institutions emerged from the analyzed data. We discuss the main characteristics in detail throughout this section.

5.1.1. Achieving membership

The content of achieving membership constitutes the activities of checking eligibility, supporting applicants and evaluating and granting exemptions. We observe that these activities follow a specific sequence (structure): firstly, including an initial eligibility check, followed by assigning a case officer, suggesting sandbox boundaries and lastly offering access to testing. As for governance, while these activities are greatly dependent upon regulators managing them, sandbox applicants play an important role in performing these activities by approaching regulators, complying with the application requirements and co-

developing testing conditions by establishing sufficient protection mechanisms.

The idea that regulators are offering proactive protection is due not only to engagement with FinTechs and monitoring participants but also to the tailoring approach (content) that regulators perform prior to achieving membership. In practice, this means that regulators work with applicants early on to tailor the best testing plan for each participant. Relatedly, our findings indicate that regulatory sandboxes have the necessary regulatory power to provide licensing reliefs and establish the boundary conditions of exemptions to fit the needs of each FinTech firm. Regulators may also use these significant powers to alter boundary conditions during participation or even to cease testing activities (such as when they observe a greater impact on clients). We may thus deduce that regulatory powers enable regulators to manage and perform the identified activities in regulatory sandboxes. Taken together, a tailoring approach and regulatory powers allow regulatory sandboxes to build risk-appropriate testing environments for FinTech participants and proactively safeguard financial systems. These activities can be attributed to the increasing number of market participants and the vital need for regulators to oversee financial markets. Theoretically, these findings are consistent with Magnuson's (2018), who argues that FinTechs constitute greater systemic risk threats than established incumbents as they are '... more vulnerable to adverse economic shocks, less transparent to regulators, and more likely to encourage excessively risky behavior by market participants' (Magnuson, 2018, p. 1167). In line with this discussion, we offer:

P1a: Regulatory sandboxes proactively protect financial markets using a dynamic tailoring approach and by exerting regulatory powers.

5.1.2. Participating

The activities performed during participating consist of supporting and supervising participants (content) – unlike achieving membership, these are conducted in a parallel sequence (structure). Notably, the scope of performed activities may vary from one regulatory jurisdiction to another, possibly due to imposed mandates and availability of resources. In terms of governance, both activities are predominantly performed by assigned case officers (regulators) with the aim of supporting newcomers in their regulatory endeavours as well as monitoring them to ensure that potential risks remain contained. Thus, our findings imply that regulators inherently operate with two functions focusing on the regulation and innovation of FinTechs, with information being exchanged and access to internal regulatory expertise provided (as highlighted in the FCA example). These observations support and further explain studies (e.g., Zetzsche et al., 2017) that describe regulatory sandboxes as promoting bi-directional knowledge exchange between regulators and FinTech participants. Specifically, regulator–innovator engagement benefits regulators by providing insights into 'innovations and the opportunities and risks they present' while offering innovators a better 'understanding of regulatory and supervisory expectations' (ESMA, 2019, p. 5).

On this basis, we postulate that knowledge-sharing within sandboxes increases regulators' understanding of the application of novel technologies and participants' knowledge of financial regulation, enabling them to create regulatory-compliant solutions. This bridges the lag between regulatory frameworks and new technologies in financial markets (IOSCO, 2017). Based on this discussion, we offer:

P1b: Regulatory sandboxes enable the transfer of regulatory and technological knowledge between regulators and FinTech participants.

5.1.3. Detaching

The content of detaching represents two activities: suspending exemptions and enforcing exiting policies. Testing activities within regulatory sandboxes may cease either during participation or when the exemption granted expires; in either case, these are linked (structure) to prior or subsequent activities like providing regulators with a completion test report after termination and applying/receiving an extension or

a financial license. Our findings also reveal that regulators closely monitor these activities, evaluating whether the unforeseen risks that emerge during testing can be mitigated and determining next steps if the participant fails to comply with the testing parameters. Although the data indicate that sandbox participants can apply to extend the exemption periods, regulators adopt a strict yet unclear extension policy. One possible explanation for these findings is that regulators are driven by a risk-based approach when evaluating participants' testing outputs – to a great extent, this explanation is supported by their consistent actions to safeguard financial markets. However, this prompts the question of how regulatory sandboxes are changing the risk-averse and highly regulated climate in financial markets in ways that may inhibit FinTech novelties when a test-and-learn approach to innovation is not effectively supported. Allen (2019) provides an extended discussion on this issue, arguing that a strict trial termination policy is required in the context of regulatory sandboxes even if this impedes innovation. The author emphasizes sandboxes as a training ground primarily for regulators. Along these lines, we suggest that:

P1c: Regulatory sandboxes adopt a consistent risk-based approach that can constrain FinTechs' freedom to test solutions.

5.1.4. Improving connectedness

We further discuss a source of value creation in the activity system that emerged as a common design theme for all the investigated jurisdictions: improving connectedness. Unlike design elements in which activities encompass all three dimensions (content, structure and governance), the source of value creation in design themes could be described in either one or more of the following themes: novelty, lock-in, complementarities and efficiency (Zott and Amit, 2010).

Our findings indicate that regulatory authorities have established cooperation agreements as well as participated in a dedicated initiative, the Global Sandbox, to promote knowledge transfer among all the investigated jurisdictions and enable testing across international jurisdictions for market participants. This initiative is an example of regulators co-creating new activities and ways of linking and managing such activities (novelty). They are thus improving connectedness first among regulators and second among international regulators and foreign sandbox participants. This can further be associated with the theme of complementarities – they create value for FinTech participants by testing FS across multiple jurisdictions with possibly different frameworks and receive support from foreign regulators (instead of running independent sandbox processes). Similarly, regulators share best practices around emergent issues associated with monitoring FinTech participants and protecting financial markets. Singapore's Sandbox Express initiative is novel in content, structure and governance, providing a different model to achieve membership and reducing time-to-testing for participants. We argue that this model reduces transaction costs for regulators because the activities are standardized (i.e., efficiency). Evidence from ADGM's case features another initiative regulators have taken to improve connectedness, this time between FinTech participants and incumbents. The Digital Sandbox is the first to adopt such an activity, representing a novelty-centred theme. This latter finding presents an alternative platform for FinTechs to take advantage of banks' financial licenses; thus, we view it in relation to recent studies that consider the role of FinTech corporate incubators in facilitating these collaborations (Block et al., 2018). For example, Hornuf et al. (2020) investigate various types of bank–FinTech alliances and find that they are most often based on product-related collaboration.

These initiatives indicate different forms of improving connectedness in financial markets as a result of collaborating with regulators, engaging with the ecosystem and developing capabilities. For instance, cooperation among regulators in the Global Sandbox may indicate that legal authorities face common regulatory challenges from FinTech participants and would benefit from sharing experiences related to enabling technologies. There might be additional urgency to collaborate, as regulatory frameworks may vary from one jurisdiction to

another, making emergent issues different in each context – at least to some extent. Given that financial trade is inherently global, another explanation could be that sandbox participants would likely express the need to extend their operations across different regulatory jurisdictions. Taken together, these cases show how regulators shape their activity system design in response to prevailing needs, thus creating new value for regulators and FinTech participants. We therefore offer the following proposition:

P1d: The sources of regulatory sandboxes' value creation can be associated with overriding themes such as novelty, complementarity and efficiency.

5.2. Comparing regulatory sandboxes' activities with other incubation models

Generic incubation models like BIs and accelerators commonly provide programs that offer support services, access to physical facilities and networking opportunities, all under general selection and exit policies (Bøllingtoft, 2012; Bruneel et al., 2012; Cohen, 2013; Hausberg and Korreck, 2018; Rubin et al., 2015). By contrast, specialized incubation models provide specifically designed services and access to sector-specific knowledge and networks (Schwartz and Hornych, 2008). Conversely, our findings indicate other service offerings, which leads us to argue that both generic and specialized BIs and accelerators are inherently different from regulatory sandboxes because of the specifics of the activities conducted. Identifying these differences provides important opportunities for research and practice to understand which specific incubation activities enable regulatory sandboxes to support FinTech start-ups. We now discuss these similarities and differences using the frameworks developed for generic (Bergek and Norrman, 2008) and specialized (Schwartz and Hornych, 2008) incubator models.

5.2.1. Activities of generic incubation models vs regulatory sandboxes

Regarding the selection practices for BIs and accelerators, the incubator literature reports using different strategies that vary by incubator focus (industry), organization type (for-profit vs non-profit) and incubation model (such as incubators or accelerators) (Hausberg and Korreck, 2018). Bergek and Norrman (2008, p. 24) classify selection strategies of incubator models into a 2 x 2 matrix framework representing 'idea-focused' and 'entrepreneur-focused' categories on the one hand and 'picking-the-winners' and 'survival-of-the-fittest' categories on the other hand. As for accelerators, selection is focused on finding entrepreneurial teams rather than individual founders (Pauwels et al., 2016). Similarly, our findings reveal that sandboxes check applicant's eligibility at an early stage, considering aspects like individual characteristics, concept readiness and having an innovative solution. We thus argue that BIs and accelerators and regulatory sandboxes conduct similar selection activities. However, we identify important differences. For example, the firm type during tenant selection varies – innovative start-ups are often eligible to access incubator and accelerator programs (Hausberg and Korreck, 2018), whereas sandboxes often focus on selecting a diverse set of ventures including FinTech start-ups, corporates and technology firms. Moreover, we found that regulators use a case-by-case tailoring approach, which contrasts with the more streamlined programs that accelerators provide (Hausberg and Korreck, 2018; Pauwels et al., 2016). Sandboxes often have the necessary regulatory power to adapt testing parameters to each FinTech firm, whereas we see no studies that indicate whether BIs and accelerators have the authority to grant exemptions or adjust regulatory framework conditions (one exception could be specialized BIs and accelerators led by regulatory authorities such as the Bank of England [Laidroo and Avarmaa, 2019]).

Moving forward, we discuss business support during participation. In the case of sandboxes, FinTech participants are mainly offered regulatory guidance. For BIs and accelerators, regulatory support is primarily accomplished through legal advice services that an external network of

law firms generally provide (Merrifield, 1987; Pauwels et al., 2016). Although specialized lawyers may well be familiar with regulatory frameworks, we argue that regulators are more competent regarding regulatory frameworks, possess legal authority and are more knowledgeable about technological developments, as they regularly interact with market participants. Thus, we assume that regulatory sandboxes have more competence in offering regulatory support than BIs and accelerators.

Further, we observe similarities in both duration and program approach (cohort-based or on a rolling basis). Specifically, prior research shows that accelerators often have cohort-based programs that last six months (Pauwels et al., 2016), whereas incubator programs offer ongoing support services for longer (ranging from three to five years) (Bergek and Norrman, 2008; Hausberg and Korreck, 2018). Comparatively, sandboxes admit applicants using either a cohort-based approach or on a rolling basis; they provide validity periods lasting from three months to two years with the opportunity to extend. While there are similarities, our findings reveal that each incubation model has its own duration period that, we argue, is determined by its objective. Specifically, sandboxes encourage tenants to apply for financial licenses during the validity period in order to transition to full-fledged, real-world operations once their exemptions end. BIs have a similar purpose – they want tenants to become self-sufficient so they can undertake business development activities after graduation (Rubin et al., 2015). However, an important factor that may determine validity periods in sandboxes is the discovery of risks during testing that, if not adequately mitigated, may lead to participant suspension. In contrast, the incubation literature does not report exit or discontinuation policies that focus on consumer risk exposure; the concern here is the risk of business failure (e.g., Schwartz, 2009).

Beside the identified similarities and differences, business support like training, mentoring, supervising and access to funding networks are not distinctive features of regulatory sandboxes, although there are a few exceptions (e.g., ADGM’s sandbox). However, when looking at monitoring, our findings suggest that regulators supervise participant activities to ensure regulatory compliance. Notably, some regulators reserve the right to impose changes to the agreed-upon parameters due to unforeseen changes. By comparison, in BIs and accelerators, monitoring incubatees’ performance is undertaken to understand tenant needs in order to develop measures that will facilitate their growth (e.g., Hackett and Dilts, 2004). Along these lines, our findings reveal that sandbox models like the Global Sandbox, Sandbox Express and Digital Sandbox enable FinTech novelties in a distinctive manner (e.g., providing access to international jurisdictions). That said, caution must be applied in interpretation, given the lack of longitudinal investigation.

Finally, we discuss differences in mediation. In this setting, an important role of incubators is to act as an intermediary that connects tenants to networks to access resources when they lack the required expertise (Bergek and Norrman, 2008). Our findings suggest that regulatory sandboxes play a mediating role; however, instead of mediating between sandbox participants and external actors to access resources like technical or industry knowledge, technology or capital, regulators facilitate access to other regulators either in the home country or internationally (FCA, 2019). By contrast, the extant incubation literature does not feature studies indicating whether BIs and accelerators collaborate with international regulatory authorities in a similar manner. Bergek and Norrman (2008) report that network mediation by BIs can either be limited to specific regions or expand to an international scope. Based on this discussion, we propose that:

P2a: Regulatory sandboxes differ from generic BIs and accelerators by providing regulatory guidance and mediating access to international jurisdictions.

5.2.2. Activities of specialized incubation models vs regulatory sandboxes

Departing from the benefits of specialized incubators (Schwartz and Hornych, 2008), we compare our findings with the activities of

FinTech-specialized incubation models discussed in the literature.

Starting with specialized facilities, our findings generally do not indicate that sandboxes offer access to such facilities. This does not apply to ADGM’s sandbox, which provides participants with access to synthetic data for testing and physical facilities such as meeting rooms. In contrast, the limited literature discussing FinTech-specific incubation models indicates that FinTechs may benefit from mentorship, access to customer bases, knowledge of banking regulations and access to financial licenses when partnering with incumbents or achieving membership in a corporate BIs (e.g., Hornuf et al., 2020; Sinha, 2017). We further argue that neither regulators nor financial banking incubators have the knowledge needed to support FinTech participants in the face of complex technological and legal challenges. Put another way, regulators may lack technical knowledge, whereas corporate BIs and accelerators may fall short of regulatory knowledge – banking regulations may not always apply to FinTechs, whose novel application of enabling technologies may require different regulatory frameworks (Navaretti et al., 2017). In addition, when considering networks, regulators and corporate incubation models have access to dissimilar networks, each providing different advantages. For example, sandboxes provide access to regulators in international jurisdictions. Lastly, as to collaborative engagements among incubatees and image effects as additional benefits from sector-specific incubators, our findings regarding regulatory sandboxes do not illuminate these aspects; further empirical investigation is required to explore how these benefits unfold.

Overall, when comparing regulatory sandboxes to specialized incubator models that largely represent corporate BIs and accelerators in the reviewed literature, our findings lead us to argue that FinTechs would benefit from the ability to operate freely in local and international jurisdictions independent of a parent company, as in the case with corporate BIs and accelerators. Hence, we offer the following proposition:

P2b: Regulatory sandboxes differ from specialized BIs and accelerators by increasing FinTechs’ flexibility to operate and providing FinTech-specific regulatory knowledge.

Table 3 summarizes the activities of BIs and accelerators and regulatory sandboxes.

5.3. Theoretical implications

Our key contribution is to advance a novel debate on regulatory sandboxes as support organizations and establish an evidence-based foundation in the incubation literature by providing explanations in the form of theoretical propositions. Our investigation of regulatory

Table 3
Summary of the compared activities between BIs and accelerators and regulatory sandboxes (compiled by the authors).

Incubation Model Activities	BIs and Accelerators	Regulatory Sandboxes
Generic (Bergek and Norrman, 2008)		
Selection	Selective, dependent on incubator focus, organization type and incubation model	Selective, unified eligibility criteria, tailoring approach coupled with exertion of regulatory powers,
Business support	Training, mentoring, financial resources like seed-funding in accelerators, progress monitoring	Regulatory guidance and progress monitoring
Mediation	Access to networks (e.g., investors)	Access to local and non-local regulatory networks
Specialized (Schwartz and Hornych, 2008)		
Specialized facilities	Testing facilities (e.g., testing data)	Testing facilities rarely provided (except in ADGM’s case)
Sector-specific know-how and network	Technology and industry knowledge, access to industry networks	Regulatory knowledge, access to local and non-local regulators

sandboxes is novel due to the lack of academic studies exploring sandboxes from a management perspective, with most research adopting a legal perspective (e.g., Arner et al., 2016; Zetzsche et al., 2017). We use an exploratory approach to understand the activities that characterize sandboxes and to explore how these activities differ from those associated with other incubation models; this is in line with studies exploring accelerators' activities (e.g., Pauwels et al., 2016) and the benefits of sector-specific BIs on new venture creation (e.g., Gazel and Schwiendbacher, 2020; Schwartz and Hornych, 2008).

Our findings support the assumption that sandboxes provide contemporary regulatory guidance and facilitate access to testing across international jurisdictions – such activities are rare or non-existent in generic and specialized BIs and accelerators (Bergek and Norrman, 2008; Schwartz and Hornych, 2008). Additionally, we found that the tailoring approach and regulatory powers were central prior to participation, supporting regulators in their efforts to proactively protect financial markets against systemic risks. Once granted access to license-free testing (participating), ongoing conversations among regulators and sandbox participants were depicted as conducive to exchanging regulatory and technological knowledge. Moreover, our findings related to detaching reflected a risk-based rather than innovation-based approach; although this might be imperative to contain risks, it could limit the testing bandwidth for FinTech innovations. Finally, a source of value creation, improving connectedness, resembled regulatory jurisdictions' efforts in innovating sandbox models, either establishing new models like the Global Sandbox or improving existing ones. These findings are an impetus to more scientific research that investigates regulatory sandboxes' impact on fostering novelties.

Beyond the incubation literature, this study contributes to the entrepreneurial finance literature that has recently begun debating the role of new players, such as incubation models, in assisting FinTechs raise capital (Block et al., 2018). Within this literature stream, regulatory sandboxes have a positive influence on sandbox participants' ability to access capital, as regulatory costs and uncertainty are reduced (compared to FinTechs that do not access sandboxes) (Alaassar et al., 2020; Cornelli et al., 2020; Goo and Heo, 2020). We thus contribute to this growing stream of studies by elucidating how regulatory sandboxes fundamentally operate and provide regulatory guidance. Similarly, implications can be drawn for research discussing the influence of sandboxes on FinTech ecosystems (e.g., Buckley et al., 2020; Mention 2019). Our study provides insights relevant to the spatial boundaries of FinTech ecosystems, as sandbox participants may have easier access to international jurisdictions.

Other important contributions we make include using the activity system framework (Zott and Amit, 2010) to explore novel incubation models, following seminal investigations by Pauwels et al. (2016). In doing so, we respond to calls by incubation scholars to employ theoretically based approaches when investigating incubation models' activities (Bruneel et al., 2012). We employed the activity system framework to investigate the value-creating activities of regulatory sandboxes and to identify value-creation drivers that emerge from the studied cases. By using this theoretical framework, we also contribute to the broader FinTech phenomenon that remains under-theorized and lacking in sufficient scholarly attention (Gimpel et al., 2018; Puschmann, 2017). Moreover, through this lens, we extend the scholarly understanding of regulatory intervention, building on recent FinTech studies that confirm supportive regulatory initiatives have a positive impact on firm formation (Haddad and Hornuf, 2019).

5.4. Implications for practice

Our research has important implications for different stakeholders on the FinTech scene, particularly regulators, policy-makers and innovators. Through this study, we inform regulators with established regulatory sandboxes about the similarities inherent in the activities of

regulatory sandboxes, BIs and accelerators. This can help regulators develop more effective supervisory approaches by sourcing evidence-based knowledge from the established incubation literature stream. Additionally, we shed light on the presence of a predominant risk-based approach that may impede innovation testing – a more balanced approach could be devised to grant FinTechs flexible testing conditions. Active risk-gauging and innovation-friendlier thresholds would then be necessary. This is crucial to help regulators in their quest to offer effective support for novelties. As for regulatory authorities that are considering setting up a regulatory sandbox or improving established sandboxes, we provide a starting point that details the main activities undertaken by the world's most developed sandboxes. We also present a value creation driver that regulators employ. Introducing regulatory sandboxes to these jurisdictions can reduce the technology–regulation (knowledge) lag and help regulators to safeguard their financial markets.

From a policy perspective, this study is important, given the emergence of FinTechs and the need to find more effective regulatory approaches while ensuring the existence of business environments that are conducive to attracting FinTech ventures. Specifically, the identified differences in activities between sandboxes and incubation models (e.g., providing regulatory guidance, mediating access to international jurisdictions and increasing FinTechs' independence) are benefits that policy-makers can leverage to establish hospitable environments for FinTechs. Our study informs policy-makers about the diversity in sandbox models arising from differences in their mandates and the need for this support instrument, with its unique service offering that contrasts with other incubation model services. Policy-makers in jurisdictions with established sandboxes would also benefit from the provided insights, better equipping them to formulate or amend risk protection and innovation support policies.

Finally, we inform FinTech innovators about the opportunities that sandboxes can offer, which include receiving regulatory guidance and access to testing opportunities across international jurisdictions. Additionally, regulatory sandboxes allow FinTech start-ups to avoid having to partner with banks simply to obtain financial licensing, as they can test and validate their solutions without a license and thus have a better chance of raising capital and attracting investors during the validity period. Hence, this study informs FinTechs about the flexibility of operating freely without committing to larger organizations when accessing regulatory sandboxes. More broadly, the design elements detail the activities conducted in sandboxes, giving FinTech newcomers an easy introduction to regulators' requirements from initial conversations to final reporting.

6. Conclusions

Regulatory sandboxes play an important role in stimulating entrepreneurial and innovative activity among FinTechs. However, previous research on this novel support instrument provides limited insight into its activities. Hence, we explored the activities that characterize regulatory sandboxes in order to discuss how these instruments differ compared to generic and specialized BIs and accelerators. Initially, our findings suggested that regulatory sandboxes operated in a similar manner. However, when investigating the nature of sandbox activities, we found differences that resembled in providing regulatory guidance, facilitating testing across international jurisdictions and offering FinTechs flexibility to operate in financial markets. On this basis, we have derived a set of theoretical propositions to guide future research exploring incubation models, including regulatory sandboxes.

6.1. Limitations and future research

No research is without limitations. In this final section, we suggest a future research agenda to extend the scholarship on regulatory sandboxes. In addition to the following suggestions, the propositions we put

forward serve as a promising basis for future research. First, the empirical part of this paper is based on archival data sourced from webpages. Although this approach offers advantages like accessibility to documents from multiple sources, it also has drawbacks such as limited details and a lack of insights into practical examples. This limitation provides opportunities for future scholarly work to collect primary data that is richer and focuses on practical experiences. Second, our sample was restricted to five leading regulatory sandboxes established in 2016. With the rapid increase in the number of sandboxes, we encourage future research to expand the sample size under investigation. Our findings revealed distinct regulatory sandbox models, allowing future investigations to focus on certain models rather than analyzing a heterogeneous sample. Third, we explored sandboxes from the perspective of regulators, as the sample comprised documents issued by regulatory officials. To gain a deeper understanding of the incubation model of regulatory sandboxes, we urge future research to conduct a multi-perspective analysis, using our propositions as a starting point. Lastly,

there is abundant room for future research to link the study of regulatory sandboxes to other streams beyond the incubation literature stream – for instance, to managing innovation collaborations or networks.

Declaration of competing interest

None.

Acknowledgements

We sincerely appreciate the insightful feedback the three anonymous reviewers provided and the co-editors' efforts. This research has received funding from the Horizon 2020 Programme of the European Union within the OpenInnoTrain project under grant agreement no. 823971. The content of this publication does not reflect the official opinion of the European Union. Responsibility for the information and views expressed in the publication lies entirely with the author(s).

Appendix 1. List of Archival Documents

Name	Pages	Codes
ADGM CP 2	14	7
ADGM CP 3	11	7
ADGM CP3 Annex A	3	2
ADGM CP3 Annex A_2	10	3
ADGM CP3 Annex B	13	4
ADGM CP3 Annex C	2	2
ADGM Digital Sandbox	3	4
ADGM Regulatory Laboratory Guidance	12	14
ADGM Sandbox Infographic	4	9
ADGM Welcomes 3rd Cohort with SME Focus	2	3
ADGM-Press-Release-3rd-Cohort	5	4
ADGM-Regulatory-Sandbox-Process	4	4
ASIC CP260	2	2
ASIC CP297	14	4
ASIC Government Proposal for New and Improved Sandbox	4	2
ASIC Licensing Exemption Infographic 1	1	2
ASIC Press Release	2	5
ASIC Report 508 Response to CP	20	4
ASIC Report 523 on RegTech	26	11
ASIC Report 543 Response to ASIC Report on RegTech	20	7
ASIC RG257	38	12
FCA Lessons-Learned-Report	21	8
FCA Press Release Cohort 4	5	3
FCA Regulatory Sandbox	23	11
FCA Regulatory Sandbox – Cohort 2	3	3
FCA Regulatory Sandbox – Cohort 3	3	4
FCA Sandbox-Testing-Parameters	1	6
HKMA CP Authorization of Virtual Banks	7	4
HKMA Fintech Supervisory Sandbox (FSS) webpage	4	6
HKMA Innovation Hub Release Letter	3	4
HKMA Press Release – A New Era of Smart Banking	2	4
HKMA Press Release – Fintech Supervisory Chatroom	2	3
HKMA Regulatory Sandbox Release Letter	3	2
HKMA Speech by the Deputy Chief Executive on RegTech	5	9
Hong Kong Launch Regulatory Sandbox Article	6	6
MAS CP005 on Regulatory Sandbox	19	4
MAS CP015 on Sandbox Express	14	4
MAS Regulatory Sandbox Guidelines	18	10
MAS Response to CP	110	8
Total	459	211

References

ADGM (Abu Dhabi Global Market), 2016a. Consultation paper no. 3 of 2016. Retrieved from http://adgm.complinet.com/net_file_store/new_rulebooks/c/o/Consultation_Paper_No_3_of_2016_Regulatory_Framework_for_FinTech.pdf.

ADGM (Abu Dhabi Global Market), 2016b. FinTech regulatory laboratory guidance. Retrieved from http://adgm.complinet.com/net_file_store/new_rulebooks/1/1/FinTech_RegLab_Guidance_VER01_31082016.pdf.

ADGM (Abu Dhabi Global Market), 2018. Abu Dhabi global market announces launch of digital sandbox to accelerate financial services innovation and financial inclusion in the UAE and the region [press release]. Retrieved from <https://www.adgm.com/mediacentre/press-releases/adgm-announces-launch-of-digital-sandbox-to-ac>

- elerate-financial-services-innovation-and-financial-inclusion-in-the-uae-and-th-e-region/.
- Aerts, K., Matthyssens, P., Vandenbempt, K., 2007. Critical role and screening practices of European business incubators. *Technovation* 27 (5), 254–267. <https://doi.org/10.1016/j.technovation.2006.12.002>.
- Alaassar, A., Mention, A.L., Aas, T.H., 2020. Exploring how social interactions influence regulators and innovators: the case of regulatory sandboxes. *Technol. Forecast. Soc. Change* 160, 120257. <https://doi.org/10.1016/j.techfore.2020.120257>.
- Allen, H.J., 2019. Regulatory sandboxes. *George Wash. Law Rev.* 87 (3), 579–645. <https://heinonline.org/HOL/P?h=hein.journals/gwlr87&i=625>.
- Arner, D.W., Barberis, J., Buckley, R.P., 2015. The evolution of fintech: a new post-crisis paradigm. *Georgetown J. Int. Law* 47, 1271–1315. <https://heinonline.org/HOL/LandingPage?handle=hein.journals/geojint47&div=41&id=&page=->.
- Arner, D.W., Barberis, J., Buckley, R.P., 2016. FinTech, RegTech, and the reconceptualization of financial regulation. *Northwestern Journal of International Law & Business* 37 (3), 371–413. <https://heinonline.org/HOL/LandingPage?handle=hein.journals/nwjl37&div=17&id=&page=->.
- Arner, D.W., Barberis, J., Buckley, R.P., 2017. FinTech and RegTech in a nutshell, and the future in a sandbox. *Research Foundation Briefs* 3 (4), 1–20. <https://www.cfainstitute.org/research/foundation/2017/fintech-and-regtech-in-a-nutshell-and-the-future-in-a-sandbox>.
- ASIC (Australian Securities and Investments Commission), 2017a. ASIC's Innovation Hub and our approach to regulatory technology. Retrieved from <https://download.asic.gov.au/media/4270022/rep523-published-26-may-2017.pdf>.
- ASIC (Australian Securities and Investments Commission), 2017b. Retaining ASIC's FinTech licensing exemption CP297. Retrieved from <https://asic.gov.au/regulatory-resources/find-a-document/consultation-papers/cp-297-retaining-asic-s-fintech-licensing-exemption/>.
- ASIC (Australian Securities and Investments Commission), 2017c. Testing fintech products and services without holding and AFS or credit license RG 257. Retrieved from <https://download.asic.gov.au/media/4420907/rg257-published-23-august-2017.pdf>.
- Baraldi, E., Havenvid, M.I., 2016. Identifying new dimensions of business incubation: a multi-level analysis of Karolinska Institute's incubation system. *Technovation* 50, 53–68. <https://doi.org/10.1016/j.technovation.2015.08.003>.
- Bergek, A., Norrman, C., 2008. Incubator best practice: a framework. *Technovation* 28 (1–2), 20–28. <https://doi.org/10.1016/j.technovation.2007.07.008>.
- Blind, K., 2012. The influence of regulations on innovation: a quantitative assessment for OECD countries. *Res. Pol.* 41 (2), 391–400. <https://doi.org/10.1016/j.respol.2011.08.008>.
- Block, J.H., Colombo, M.G., Cumming, D.J., Vismara, S., 2018. New players in entrepreneurial finance and why they are there. *Small Bus. Econ.* 50 (2), 239–250.
- Bøllingtoft, A., 2012. The bottom-up business incubator: leverage to networking and cooperation practices in a self-generated, entrepreneurial-enabled environment. *Technovation* 32 (5), 304–315. <https://doi.org/10.1016/j.technovation.2011.11.005>.
- Bromberg, L., Godwin, A., Ramsay, I., 2017. Fintech sandboxes: achieving a balance between regulation and innovation. *J. Bank. Finance Law Pract.* 28 (4), 314–336. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3090844.
- Bruneel, J., Ratinho, T., Clarysse, B., Groen, A., 2012. The evolution of business incubators: comparing demand and supply of business incubation services across different incubator generations. *Technovation* 32 (2), 110–121. <https://doi.org/10.1016/j.technovation.2011.11.003>.
- Buckley, R.P., Arner, D., Veidt, R., Zetsche, D., 2020. Building FinTech ecosystems: regulatory sandboxes, innovation hubs and beyond. *Wash. Univ. J. Law Pol.* 61, 55–99. <https://go.gale.com/ps/anonymously?id=GALE%7CA624519513&sid=gooleScholar&v=2.1&it=r&linkaccess=abs&issn=15334686&p=AONE&sw=w>.
- Campbell, C., Kendrick, R.C., Samuelson, D.S., 1985. Stalking the latent entrepreneur: business incubators and economic development. *Econ. Dev. Rev.* 3 (2), 43–49.
- CBInsights, 2018. FinTech trends to watch in 2018. Retrieved from <https://www.cbinsights.com/reports/CB-Insights-Fintech-Trends-2018.pdf>.
- CCAF (Cambridge Centre for Alternative Finance), 2018. Guide to promoting financial & regulatory innovation: insights from the UK. Retrieved from https://www.jbs.cam.ac.uk/fileadmin/user_upload/research/centres/alternative-finance/downloads/2018-06-ccaf-whitepaper-guide-to-promoting-financial-regulation-innovation.pdf.
- Cleary, M., Horsfall, J., Hayter, M., 2014. Data collection and sampling in qualitative research: does size matter? *J. Adv. Nurs.* 70 (3), 473–475. <https://doi.org/10.1111/jan.12163>.
- Cohen, S., 2013. What do accelerators do? Insights from incubators and angels. *Innovations: Technology, Governance, Globalization* 8 (3–4), 19–25. https://www.mitpressjournals.org/doi/pdf/10.1162/INOVA_00184.
- Cornelli, G., Doerr, S., Gambacorta, L., Merrouche, O., 2020. Inside the Regulatory Sandbox: Effects on Fintech Funding. Bank for International Settlements. Retrieved from <https://www.bis.org/publ/work901.htm>.
- Doblinger, C., Surana, K., Anadon, L.D., 2019. Governments as partners: the role of alliances in US cleantech startup innovation. *Res. Pol.* 48 (6), 1458–1475. <https://doi.org/10.1016/j.respol.2019.02.006>.
- DOE (Department of Energy), 2018. National incubator initiative for clean energy (NIICE). Retrieved from <https://www.energy.gov/eere/technology-to-market/national-incubator-initiative-clean-energy-niice-0>.
- Dubois, A., Gadde, L.-E., 2002. Systematic combining: an abductive approach to case research. *J. Bus. Res.* 55 (7), 553–560. [https://doi.org/10.1016/S0148-2963\(00\)00195-8](https://doi.org/10.1016/S0148-2963(00)00195-8).
- Dubois, A., Gadde, L.-E., 2014. 'Systematic combining'—a decade later. *J. Bus. Res.* 67 (6), 1277–1284. <https://doi.org/10.1016/j.jbusres.2013.03.036>.
- ESMA (European Securities and Markets Authority), 2019. FinTech: regulatory sandboxes and innovation hubs. Retrieved from <https://eba.europa.eu/documents/10180/2545547/JC+2018+74+Joint+Report+on+Regulatory+Sandboxes+and+Innovation+Hubs.pdf>.
- Fan, P.S., 2017. Singapore approach to develop and regulate FinTech. In: Lee, D., Deng, R.H. (Eds.), *Handbook of Blockchain, Digital Finance, and Inclusion*, tome 1. Elsevier, Amsterdam, pp. 347–357.
- FCA (Financial Conduct Authority), 2015. Regulatory sandbox. Retrieved from <https://www.fca.org.uk/publication/research/regulatory-sandbox.pdf>.
- FCA (Financial Conduct Authority), 2017. Regulatory sandbox lessons learned report. Retrieved from <https://www.fca.org.uk/publication/research-and-data/regulatory-sandbox-lessons-learned-report.pdf>.
- FCA (Financial Conduct Authority), 2019. Global financial innovation network (GFIN). Retrieved from <https://www.fca.org.uk/firms/global-financial-innovation-network>.
- FSB (Financial Stability Board), 2017. Financial stability implications from FinTech: supervisory and regulatory issues that merit authorities' attention. Retrieved from <http://www.fsb.org/wp-content/uploads/R270617.pdf>.
- Gaur, A., Kumar, M., 2018. A systematic approach to conducting review studies: an assessment of content analysis in 25 years of IB research. *J. World Bus.* 53 (2), 280–289. <https://doi.org/10.1016/j.jwb.2017.11.003>.
- Gazel, M., Schwienbacher, A., 2020. Entrepreneurial fintech clusters. *Small Bus. Econ.* <https://doi.org/10.1007/s11187-020-00331-1>.
- GFIN (Global Financial Innovation Network), 2018. Global financial innovation network (GFIN): consultation document. Retrieved from <https://www.fca.org.uk/publication/consultation/gfin-consultation-document.pdf>.
- Gimpel, H., Rau, D., Röglinger, M., 2018. Understanding FinTech start-ups: a taxonomy of consumer-oriented service offerings. *Electron. Mark.* 28, 245–264. <https://doi.org/10.1007/s12525-017-0275-0>.
- Gioia, D.A., Corley, K.G., Hamilton, A.L., 2013. Seeking qualitative rigor in inductive research: notes on the Gioia methodology. *Organ. Res. Methods* 16 (1), 15–31. <https://doi.org/10.1177/1094428112452151>.
- Goo, J.J., Heo, J.Y., 2020. The impact of the regulatory sandbox on the fintech industry, with a discussion on the relation between regulatory sandboxes and open innovation. *Journal of Open Innovation: Technology, Market, and Complexity* 6 (2), 43. <https://doi.org/10.3390/joitmc6020043>.
- Gozman, D., Willcocks, L., 2019. The emerging cloud dilemma: balancing innovation with cross-border privacy and outsourcing regulations. *J. Bus. Res.* 97, 235–256. <https://doi.org/10.1016/j.jbusres.2018.06.006>.
- Gozman, D., Liebenau, J., Mangan, J., 2018. The innovation mechanisms of Fintech start-ups: insights from SWIFT's Innobrite Competition. *J. Manag. Inf. Syst.* 35 (1), 145–179. <https://doi.org/10.1080/07421222.2018.1440768>.
- Grifantini, K., 2015. Incubating innovation: a standard model for nurturing new businesses, the incubator gains prominence in the world of biotech. *IEEE Pulse* 6 (6), 27–31. <https://doi.org/10.1109/MPUL.2015.2476542>.
- Grimaldi, R., Grandi, A., 2005. Business incubators and new venture creation: an assessment of incubating models. *Technovation* 25 (2), 111–121. [https://doi.org/10.1016/S0166-4972\(03\)00076-2](https://doi.org/10.1016/S0166-4972(03)00076-2).
- Hackett, S.M., Dilts, D.M., 2004. A systematic review of business incubation research. *J. Technol. Tran.* 29 (1), 55–82. <https://doi.org/10.1023/B:JOTT.0000011181.11952.0f>.
- Haddad, C., Hornuf, L., 2018. The emergence of the global fintech market: economic and technological determinants. *Small Bus. Econ.* 53, 81–105. <https://doi.org/10.1007/s11187-018-9991-x>.
- Hausberg, J.P., Korreck, S., 2018. Business incubators and accelerators: a co-citation analysis-based, systematic literature review. *J. Technol. Tran.* 45, 151–176. <https://doi.org/10.1007/s10961-018-9651-y>.
- HKMA (Hong Kong Monetary Authority), 2016. Fintech supervisory sandbox (FSS) [press release]. Retrieved from <https://www.hkma.gov.hk/media/eng/doc/key-information/guidelines-and-circular/2016/20160906e1.pdf>.
- HKMA (Hong Kong Monetary Authority), 2017. A new era of smart banking [press release]. Retrieved from <https://www.hkma.gov.hk/eng/key-information/press-releases/2017/20170929-3.shtml>.
- Hornuf, L., Schwienbacher, A., 2017. Should securities regulation promote equity crowdfunding? *Small Bus. Econ.* 49 (3), 579–593. <https://doi.org/10.1007/s11187-017-9839-9>.
- Hornuf, L., Klus, M.F., Lohwasser, T.S., Schwienbacher, A., 2020. How do banks interact with fintech startups? *Small Bus. Econ.* 1–22. <https://doi.org/10.1007/s11187-020-00359-3>.
- IOSCO (International Organization of Securities Commissions), 2017. Research report on financial technologies (fintech) by the international organization of securities commissions (IOSCO). Retrieved from <https://www.iosco.org/library/pubdocs/pdf/IOSCOPD554.pdf>.
- Jenik, I., Lauer, K., 2017. Regulatory Sandboxes and Financial Inclusion. CGAP, Washington, DC. Retrieved from <https://www.cgap.org/sites/default/files/researches/documents/Working-Paper-Regulatory-Sandboxes-Oct-2017.pdf>.
- Jenik, I., Sharmista, A., 2019. CGAP-World Bank: regulatory sandbox global survey. Retrieved from <https://www.findevgateway.org/library/cgap-world-bank-regulatory-sandbox-global-survey-2019>.
- Laidroo, L., Avarmaa, M., 2019. The role of location in FinTech formation. *Entrepreneurship & Regional Development.* <https://doi.org/10.1080/08985626.2019.1675777>.
- Lee, I., Shin, Y.J., 2018. Fintech: ecosystem, business models, investment decisions, and challenges. *Bus. Horiz.* 61 (1), 35–46. <https://doi.org/10.1016/j.bushor.2017.09.003>.

- Löfsten, H., Lindelöf, P., 2002. Science parks and the growth of new technology-based firms—academic-industry links, innovation and markets. *Res. Pol.* 31 (6), 859–876. [https://doi.org/10.1016/S0048-7333\(01\)00153-6](https://doi.org/10.1016/S0048-7333(01)00153-6).
- Magnuson, W., 2018. Regulating FinTech. *Vanderbilt Law Rev.* 71 (4), 1167–1226. <https://heinonline.org/HOL/LandingPage?handle=hein.journals/vanr71&div=33&id=&page=>.
- Mangano, R., 2018. Blockchain securities, insolvency law and the sandbox approach. *Eur. Bus. Organ Law Rev.* 19 (4), 715–735. <https://doi.org/10.1007/s40804-018-0123-5>.
- MAS (Monetary Authority of Singapore), 2016. FinTech regulatory sandbox guidelines. Retrieved from <http://www.mas.gov.sg/~media/Smart%20Financial%20Centre/Sandbox/FinTech%20Regulatory%20Sandbox%20Guidelines%2019Feb2018.pdf>.
- MAS (Monetary Authority of Singapore), 2018. Sandbox express. Retrieved from <http://www.mas.gov.sg/~media/MAS/News%20and%20Publications/Consultation%20Papers/2018%20Nov%20Sandbox%20Express/Consultation%20Paper%20on%20Sandbox%20Express.pdf>.
- Mention, A.L., 2019. The future of Fintech. *Res. Technol. Manag.* 62 (4), 59–63. <https://doi.org/10.1080/08956308.2019.1613123>.
- Merrifield, D.B., 1987. New business incubators. *J. Bus. Ventur.* 2 (4), 277–284. [https://doi.org/10.1016/0883-9026\(87\)90021-8](https://doi.org/10.1016/0883-9026(87)90021-8).
- Mian, S., Lamine, W., Fayolle, A., 2016. Technology business incubation: an overview of the state of knowledge. *Technovation* 50–51, 1–12. <https://doi.org/10.1016/j.technovation.2016.02.005>.
- Michael, S.C., Pearce, J.A., 2009. The need for innovation as a rationale for government involvement in entrepreneurship. *Enterpren. Reg. Dev.* 21 (3), 285–302. <https://doi.org/10.1080/08985620802279999>.
- Navaretti, G.B., Calzolari, G., Pozzolo, A.F., 2017. FinTech and banks. Friends or foes? European economy – banks, regulation, and the real sector 2, 9–30. https://european-economy.eu/wp-content/uploads/2018/01/EE_2.2017-2.pdf.
- Pai, S., Producer), 2017. ‘Scaling up’ FinTech innovation. Retrieved from <https://www.cappgemini.com/2017/07/scaling-up-fintech-innovation/>.
- Pauwels, C., Clarysse, B., Wright, M., Van Hove, J., 2016. Understanding a new generation incubation model: the accelerator. *Technovation* 50–51, 13–24. <https://doi.org/10.1016/j.technovation.2015.09.003>.
- Peters, L., Rice, M., Sundararajan, M., 2004. The role of incubators in the entrepreneurial process. *J. Technol. Tran.* 29 (1), 83–91. <https://doi.org/10.1023/B:JOTT.0000011182.82350.df>.
- Phillippon, T., 2016. The Fintech Opportunity. National Bureau of Economic Research, Cambridge, MA. NBER Working Paper, 22476. <https://www.nber.org/papers/w22476.pdf>.
- Puschmann, T., 2017. Fintech. *Business & Information Systems Engineering* 59 (1), 69–76. <https://doi.org/10.1007/s12599-017-0464-6>.
- Ringe, W.-G., Ruof, C., 2018. A Regulatory Sandbox for Robo Advice. University of Hamburg, Institute of Law and Economics (ILE), Hamburg. ILE Working Paper, 14. <https://www.econstor.eu/bitstream/10419/179514/1/ile-wp-2018-14.pdf>.
- Rubin, T.H., Aas, T.H., Stead, A., 2015. Knowledge flow in technological business incubators: evidence from Australia and Israel. *Technovation* 41–42, 11–24. <https://doi.org/10.1016/j.technovation.2015.03.002>.
- Schwartz, M., 2009. Beyond incubation: an analysis of firm survival and exit dynamics in the post-graduation period. *J. Technol. Tran.* 34 (4), 403–421. <https://doi.org/10.1007/s10961-008-9095-x>.
- Schwartz, M., Hornych, C., 2008. Specialization as strategy for business incubators: an assessment of the Central German Multimedia Center. *Technovation* 28 (7), 436–449. <https://www.sciencedirect.com/science/article/abs/pii/S0166497208000187>.
- Sinha, S., 2017. A Glimpse into the World of FinTech Accelerators? The Open Vault at OCBC. *IEEE Potentials* 36 (6), 20–23. <https://doi.org/10.1109/MPOT.2017.2737238>.
- Stayton, J., Mangematin, V., 2019. Seed accelerators and the speed of new venture creation. *J. Technol. Tran.* 44 (4), 1163–1187. <https://doi.org/10.1007/s10961-017-9646-0>.
- Teigland, R., Siri, S., Larsson, A., Puertas, A.M., Bogusz, C.I., 2018. Introduction: FinTech and shifting financial system institutions. In: Teigland, R., Siri, S., Larsson, A., Puertas, A.M., Bogusz, C.I. (Eds.), *The Rise and Development of FinTech: Accounts of Disruption from Sweden and beyond*. Routledge, London, pp. 1–18.
- UNSGSA (United Nations Secretary-General’s Special Advocate), MAS (Monetary Authority of Singapore), CCAF (Cambridge Centre for Alternative Finance), 2019. Early lessons on regulatory innovations to enable inclusive FinTech: innovation offices, Regulatory sandboxes, and RegTech. Retrieved from https://www.jbs.cam.ac.uk/fileadmin/user_upload/research/centres/alternative-finance/downloads/2019-early-lessons-regulatory-innovations-enable-inclusive-fintech.pdf.
- Vanderstraeten, J., Matthyssens, P., 2012. Service-based differentiation strategies for business incubators: exploring external and internal alignment. *Technovation* 32 (12), 656–670. <https://doi.org/10.1016/j.technovation.2012.09.002>.
- Vygotsky, L. S. 1978. *Mind in Society*. Cole, M., John-Steiner, V., Scribner, S., Souberman, E. (Eds.), Harvard University Press, Cambridge, MA.
- Wang, Y., Hajli, N., 2017. Exploring the path to big data analytics success in healthcare. *J. Bus. Res.* 70, 287–299. <https://doi.org/10.1016/j.jbusres.2016.08.002>.
- Zetzsche, D.A., Buckley, R.P., Barberis, J.N., Arner, D.W., 2017. Regulating a revolution: from regulatory sandboxes to smart regulation. *Fordham J. Corp. Financ. Law* 23, 31–103. <https://heinonline.org/HOL/LandingPage?handle=hein.journals/fjcf23&div=5&id=&page>.
- Zott, C., Amit, R., 2010. Business model design: an activity system perspective. *Long. Range Plan.* 43 (2–3), 216–226. <https://doi.org/10.1016/j.lrp.2009.07.004>.