

InGAME

Innovation for Games
and Media Enterprise

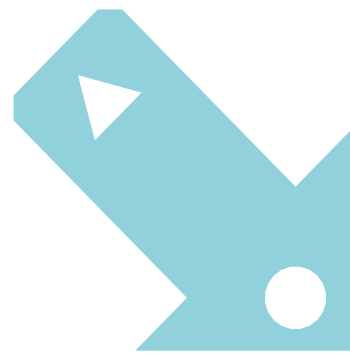
Cluster Programme Report, 2023

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Executive Summary

Innovation for Games and Media Enterprise (InGAME) is a research and development centre dedicated to making Dundee the home of world-leading innovation for videogames, interactive media and immersive technologies.

InGAME is one of nine creative clusters formed in 2018 as part of the UK Industrial Strategy's Creative Industries Cluster Programme (CICP). InGAME's work with games companies in the city and beyond is led by Abertay University, in partnership with the University of Dundee, the University of St Andrews, and local and international industry partners. It is funded by an £11-million grant by the Arts & Humanities Research Council (AH/S002871/1), with further funding from the Scottish Funding Council, and investment of R&D expertise and technologies from industry and academic partners.

Three challenges in the Dundee cluster guide InGAME's activities:

- to de-risk developers' creative experimentation and commercialisation
- to develop their scale-up and organisational capabilities
- to diversify and incentivise innovation opportunities

InGAME responded to these challenges during 2018-2023 through a programme of over 177 collaborative research and development (CR&D) interventions and events, delivered by 38 full- and part-time project staff, research fellows, and academic investigators, in concert with industry and third-sector partners.

Detailed measurement of the economic impacts of InGAME is provided in adjacent reports (see innovationforgames.com). Among these, InGAME activity is expected to generate over 10 years more than 175 jobs in Scotland, with £84.7 million Gross Value Added to the economy (BiGGAR Economics 2023).

In this report, we analyse how InGAME achieved its goal of increasing scale and value in the Dundee cluster. The report focuses on the enabling capacity of the project, capturing learning on the innovations necessary to achieve outstanding impacts for cluster companies and InGAME partners. Growth in the cluster is demonstrated in enhanced organisational and innovation capacities and shared learning through collaborative research and development activities. As a result of InGAME's activities a new route for applied games development has emerged, pioneering a future for games technology.

We begin by summarising the conditions which sparked InGAME, then describe how the project organised CICP partner resources to deliver responsive Collaborative Research and Development. Short case studies illustrate the variety of interventions deployed, including applied games labs, industry challenge calls, innovation vouchers, embedded research and cluster capacity building. The report closes with a chapter reflecting on InGAME as a videogames production field drawing on the work of sociologist Pierre Bourdieu, a framing which focuses attention on the dynamic reality of agents' use of field logics to maximise multiple forms of capital, and where growth and innovation opportunities, particularly in non-economic terms, are brokered by InGAME acting as a cultural intermediary (Bourdieu 1993).

Key Findings

Analysis in this report provides understandings of the impact of InGAME that supplement those arising from other evaluative means (see innovationforgames.com). We parse InGAME's approach to catalysing scale and value using Bourdieu's field framework, on which we build understandings of the social space in which it operates. These illuminate how InGAME's design, development, technological and organisational innovations organise practice, providing insights which can be transferred to other industries and social sectors. In particular, we highlight the importance of:

1. **Apprehending the practice field:** Initiated in the planning stages for InGAME and continued throughout its delivery, assessment of the typical forms of capital valued by cluster studios, and their logics (e.g. business plans) for pursuing and exchanging these forms of value, informed InGAME's own strategy for applying resources to activate cluster growth—practice we now understand as cultural intermediation. Understanding the range of capitals in play focussed cluster partners to look beyond purely economic capital accumulation and market exchange, to more foundational issues such as business and technological capacities, and aspirations toward diversification. InGAME's most recent field focus, on the expanding horizons of videogames applications, challenges beliefs about the very nature, purpose and worth of the videogames field, particularly in relation to societal issues.
2. **Field intermediation:** Our analysis illuminates the resources and the role of InGAME as an innovation broker, or cultural intermediary, a model which could be introduced to stimulate cultural production in other contexts. The legacy of InGAME lies in its practice model for adding value through collaborative R&D, activating participants' resources for profiting symbolically and materially. Its sense-and-respond operations engine, its Applied Games Labs for catalysing solutions-focussed IP, and its theory of change and exploration of applications to other fields, have generated significant achievements which will continue to pay dividends to the cluster and beyond. Meanwhile InGAME's own symbolic capital, particularly its recognition as a productive intermediary of the videogames field, has grown as the programme has progressed, leaving the model and partnerships in ideal position for further contributions.

3. **Defining and challenging boundaries:** Consideration of the cluster's boundaries and their varying interpretations raises questions about the degree to which material and geographic borders are desirable for research and development in the creative industries. As workers and organisations continue to operate in more distributed ways, supported by technology and conceptions of new realities such as the metaverse, perhaps clusters will be better defined by their goals or capabilities. Future support to enable governments and industries to capitalise on hubs of activity defined by physical location may require re-thinking as cultural production fields such as videogames and interactive media development thrive on disrupting the status quo. Indeed, it is through continuous monitoring of field horizons and enabling studios to reach beyond them, that InGAME has activated its theory of change regarding impactful videogames development of the future.

In summary, we find InGAME added value to the Dundee cluster by enhancing participants' capital, shifting their logics that define success and by pioneering new ideas about applying videogames design and technologies to critical social, environmental, and other challenges. As InGAME's inaugural programme concludes, its legacy emerges: a model creative industry cluster, with academic and commercial partners combining forces to catalyse growth and re-imagine the potential of videogames, its many achievements now embedded in Dundee games companies.

Chapter 1

Introduction

Although originating as entertainment, videogames—and their allied interactive and immersive technologies—are now integral to our economies and social lives, helping drive the continual march of technology and creativity (PEC 2023). In this epoch of digimodernism (Muriel and Crawford 2018), the global videogames market is expected to generate \$211.2 billion and involve 3.5 billion players by 2025 (Newzoo 2022). Its consumers, growing increasingly diverse across age groups and genders, not only play games but also attend professional esports tournaments, (its own market worth £2.5 billion in 2015), consume video content about games, and are among the early adopters of new technological frontiers such as augmented and virtual reality (ESA 2019, Ukie 2015). Higher education institutions prepare workers for careers in games development and increasingly, esports, the former combining expertise in art, animation, computer programming, digital media production and service, all matched by commercialisation skills such as business management, marketing and sales.

Yet games are not the sector's only output, as the skills, creativity and technologies that produce them are increasingly applied to challenges of contemporary society, such as the climate crisis, disease, future food production, and work productivity. This growing interest in the videoludification of society (Muriel and Crawford 2018) propels games companies to work across and ahead of material and disciplinary boundaries.

In short, videogames matter to our cultures and economies. To match their potential, Dundee's videogames developers, particularly its start-ups and micro- to medium-sized companies (SMEs), must grow their capacities and the value of their outputs, to ensure they can compete and sustain viability within the global games market. InGAME's activities are designed to address and solve such cluster challenges collaboratively.

Informally, Dundee's games cluster has grown over the last four decades as development studios and allied organisations have found benefits to working locally and mutually. Recognising that certain industries similarly develop regional orientations, government strategy and academic research has sought ways to learn from and maximise clustered industries. The UK's £80 million CICP initiative is its most significant investment yet, as it aims to amplify clusters' international commercial potential by boosting their innovation resources and outputs (creativeindustriesclusters.com).

Awarded CICP status in 2018, Dundee's cluster launched InGAME to increase its scale and value. This means tackling and de-risking challenges that stand in the way of further growth, and unlocking opportunities for start-ups and SMEs in Dundee and beyond. InGAME achieves this by working with research and development partners in concert with the SMEs, to address topics such as organisational capacity and development, innovation processes, investment needs, applied games development, and product diversification.

In the chapters that follow, we examine the Dundee cluster challenges and opportunities that precipitated the InGAME project, and detail InGAME's solution: a collaborative R&D programme for action, based in the heart of the Dundee cluster.

Report Chapters

Beyond this Introduction, the report is arranged as follows:

- Chapter 2: Pre InGAME: The State of Play in the Dundee Cluster. Who are its stakeholders, and what are the cluster's challenges and opportunities?
- Chapter 3: Organising InGAME. How the CICP was designed to build scale and value through Collaborative R&D and the InGAME Engine, its programme delivery model.
- Chapter 4: Growing Scale and Value. This chapter illustrates how InGAME meets its objectives, providing short Case Studies of interventions and outcomes.
- Chapter 5: Dundee as Videogames Production Field. Recasting the InGAME story with Pierre Bourdieu's (1984, 1993) theory of cultural production fields and their dynamic interplay of capitals and logics. This analysis deepens understanding of InGAME's organisation and activity, aiding extension of its legacy to other creative fields and contexts. The chapter further explains how InGAME plays the vital role of cultural intermediary as it brokers growth and innovation opportunities for other field players.
- Appendix: Selected Publications by InGAME project members
- References cited

Acknowledgements

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InGAME Project and Delivery Partners

InGAME is a multi-institution, multi-disciplinary collaboration delivered by a team of project researchers, managers and academic investigators seconded from higher education partners, and by industry and public sector partners from within the cluster and beyond. Many team members bring with them familiarity with cluster companies and their challenges, while all inject knowledge and methods from diverse worlds of creativity, technology and academia. Combined, the research and development capacity of InGAME is far-reaching. (Asterisks beside names below indicate membership of InGAME governance boards.)

Project Team

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Prof Robin Sloan, Co-Investigator, School of Design & Informatics, Abertay University
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Delivery Partners

Central to the InGAME project is its work with delivery partners within the Dundee videogames sector and beyond. These bodies informed, provoked, tested, and resourced InGAME's R&D activities and capacity-building events.

4J Studios/ Prof Chris van der Kuyl, Chairman*
Agency of None
Colin Anderson, InGAME Industry Fellow and Director, Denki*
BiGGAR Economics
Creative Dundee/ Gillian Easson, Executive Director*
Creative Scotland/ Clive Gillman, Director, Creative Industries*
Creative UK
Department for Culture, Media and Sport (DCMS)
Dundee City Council
Dundee Design Festival/ UNESCO City of Design (V&A Dundee)
Google
Indie Champions
InGAME International
Interface/ Howell Davies, Project Manager*
Knowledge Transfer Network/ Innovate UK
Malta Enterprise
Michelin Scotland Innovation Parc
Microsoft/ Lee Stott, EMEA Leader Academic Engagement*
Nesta
Open Inclusion
Outplay Entertainment/ Douglas Hare, Chief Executive Officer*
Pulse North
Roblox / Prof Kenny Mitchell, Technical Director of Rendering*
Science Museum
Scottish 5G Centre
Scottish Future Trust
Scottish Development International
Scottish Enterprise/ Sharon Pryde, Technology & Innovation*
Scottish Funding Council
Scottish Games Network
Sony Interactive Entertainment Europe/ Luke Savage, Senior Academic Development Manager*
StoryFutures Academy
TayScreen/ Julie Craik, Project Manager*
The Independent Games Developers Association (TIGA)
UK Games Development Fund
UK Interactive Entertainment (Ukie)/ Dan Wood, Chief Operating Officer*
V&A Dundee
Women in Games

Governance

InGAME's operations are overseen by management, steering, and brain trust boards comprised of representatives of the academic institutions, co-directors, funding bodies and industry and public-sector stakeholder representatives. The Steering Board Chair is the Principal of Abertay University, Professor Liz Bacon.

Chapter 2

Pre-InGAME: The State of Play in the Dundee Cluster

This chapter sets the stage for the following chapters' descriptions of how InGAME approached the needs of Dundee's videogames cluster. First, we draw the boundaries of Dundee's videogames industry as a creative cluster, then introduce its primary stakeholders. We then summarise the cluster opportunities and challenges that precipitated the InGAME programme.

Drawing Dundee and its Reach: From 'Two Square Miles' to the World

The boundaries of Dundee's games sector have been primarily determined by the city's geography, industrial heritage and academic institutions. As a North Sea port built on the Tay estuary, Dundee has been a centre of commerce, industry and shipping since the 12th century, and a gateway to the world for communities in the surrounding uplands and straths, regions now known as Angus, Fife, and Perth & Kinross. While Dundee whalers hunted in distant seas, factories back home made the city an industrial revolution powerhouse. In the years since, its continuing spirit for technological and commercial innovation earned Dundee international standing in sectors as diverse as 'jute, jam and journalism'—a late-20th Century marketing slogan for the city. Today, promoters capture the creativity and diversity of Dundee as 'One city, many discoveries', a wordplay on the 19th-Century Antarctic exploration ship *Discovery*, built in the city and now docked as a heritage attraction next to the V&A Dundee museum.

While the exit of multiple manufacturing firms during the 20th and 21st centuries has contributed to Dundee having some of the most sobering socio-economic indicators in Scotland (dundeecity.gov), the area subsequently became a locus for innovators and cultural entrepreneurs with vision, talent and audiences supplied by local learning institutions.

"The story of the games industry in Dundee is fundamentally marked by entrepreneurship by both businesses and the University of Abertay Dundee and its Vice Chancellor, the development of a shared culture between academics and developers, and an investment by various government agencies to help the ecosystem develop."

(McGregor et al 2010)

Videogames development started in the city in the late 1980s, when college students and technical workers in local factories began coding games for early home computers such as the Sinclair ZX Spectrum, manufactured in Dundee. Bedroom hobby became industry as the area's first games development studios formed, with pioneers DMA Design producing two world-wide successes, *Lemmings*, in 1991, and *Grand Theft Auto* in 1997.

From 1997, Abertay University began teaching the world's first computer games degree courses; in 1998-9 it worked with Scottish Enterprise Tayside and Dundee City Council to launch Dare to be Digital, an international computer games design competition, and established the UK Centre for Excellence in Computer Games Education in 2009.

As the 21st century opened, the stature of Dundee's cluster was growing. 4J Studios (adding joysticks to the city's jute, jam and journalism legacies) earned international reputation by developing *Minecraft* for Microsoft, Nintendo and Sony consoles, as did Denki's work with Disney, Nintendo and DreamWorks. Outside the industry and region, the city's healthy games development environment was recognised in multiple UK industrial reviews and strategy papers. In 2014, Nesta identified Dundee as one of six UK 'established meccas of video games production', with a 'balanced' games industry hub, or an area 'with a mix of large, established companies and small, younger companies' (Mateos-Garcia et al 2014: 30-1). A report on UK creative industries (Bazalgette 2017: 64) named Dundee as a 'one of the flagship locations for video game development in the UK', due to its concentration of games development companies, sector funding via the UK Games Fund (based in Dundee), partnerships with local universities, and its integration with other local creative industry sectors. These productive conditions were cited as combining to make Dundee 'one of the UK's most significant video games development clusters' (UK Government 2018: 26).

Thus, by 2018, Dundee was recognised nationally and internationally as an established and strategically important hub for computer games development. As the Bazalgette report (2017: 65) observes, 'All of this happens within approximately 2 square miles of the city, giving it the highest concentration of games activity in the UK'.

Mapping the Cluster

Dundee's reputation as a creative cluster captures this combination of heritage, entrepreneurship, innovation and talent within a regional locus. Creative clusters are 'agglomerations of creative businesses and workers that collaborate and compete with each other', which 'emerge as the result of long and complex processes combining creative entrepreneurship, a supportive environment, and a measure of good luck' (Mateos-Garcia and Bakhshi, 2016:7). It is because clusters pool resources, collaborate, build networks, and ultimately, drive local economic activity, that governments seek to optimise clustering through policy and funding that support systematic growth. Here we take a closer look at the Dundee cluster, identifying its primary stakeholders, the games companies and supporting institutions with local, national and international influence, which contribute to and benefit from its cluster activities.

First, the games companies: In 2017 there were approximately 40 games studios operating in the city. Typical of creative clusters, Dundee is primarily comprised of independent micro-businesses (companies with 0-9 employees) (Mateos-Garcia et al 2014). These are studios primarily producing digital products, services and experiences for cultural, entertainment, and business purposes. Mostly, they produce for mobile, tablet and personal computer (PC) platforms although there are a few companies specialising in console games.

Dundee's cluster also features dynamic, small (10-49 staff) and medium (50-249 staff) companies, whose products include original games, partnership development of other companies' games and interactive content, and adaptations of AAA (large-budget) games for console. The cluster includes support companies that develop platform and software services for the games industry, such as Unity Gaming Services. There are high-growth games companies such as Outplay Entertainment (with 150 employees, the UK's largest mobile games developer), multinationals Ninja Kiwi and Rockstar Dundee, and 4J, one of the most successful games developers in the world. Finally, the cluster includes Beano Studios, an interactive media studio within the long-established Dundee news company DC Thomson, and the Biome Collective of independent game developers, which collaborates to explore creative production involving games, digital art and technology.

A further boon to Dundee's games cluster is the creative stimulation provided by the city's adjacent cultural and creative industries. This features a number of institutions with national or international standing, including: Dundee Repertory Theatre, Scottish Dance Theatre, Dundee Contemporary Arts, NEoN Digital Art, UNESCO City of Design Dundee and V&A Dundee. More local organisations provide business support, networking, collaborative working and events, comprising a network always stimulating further innovation. These have included Creative Dundee, Fleet Collective, Dundee Tech Meetup, Dundee Makerspace, and Dundee University Incubator (Tech City 2017).

Dundee's local higher education institutions supply the videogames cluster with skilled workers and access to leading-edge research. Abertay, Dundee and St Andrews universities are foundational to the cluster, collectively enrolling 1,817 students in games design and technology-related courses in 2018-19 (InGAME 2020). Conducting creative industries-focussed research with public bodies, agencies, and business is established practice in all three Universities. Abertay, Duncan of Jordanstone College of Art & Design (Dundee University) and the University of St Andrews Business School have a track record of jointly pursuing multiple lines of knowledge and innovation through multi-million-pound, research council-funded programmes (Capitalising on Creativity, 2008-2015; Design in Action, 2012-2016). Abertay University's National Centre for Excellence in Computer Games Education involves collaboration among national and multi-national games companies, universities, and agencies. A technical college in the region, Dundee & Angus College, further contributes to the cluster's supply of skilled workers in computing and creative media.

Targeted financial support is regarded as a further essential ingredient in the Dundee mix. Initially launched in 2010 as the Video Games Prototype Fund, the UK Games Fund uses UK Government money to support SMEs creating new intellectual property (IP) in games. Based in Dundee, the UK Games Talent and Finance community interest company awards this funding to early-stage companies nationwide, and runs the annual Tranzfuser team competition for graduates, aiming to create jobs, promote diverse teams, and extend skills.

Politically and financially, the cluster has benefitted from the priority placed on cultural and economic development by Dundee City Council. From 2000 to 2013, the city worked with Scottish Enterprise and the Scottish Development Agency to deliver Interactive Tayside, a programme providing physical spaces, marketing and business advice to games companies.

The authority was a primary player in promoting Dundee as a cultural and creative centre, attracting the V&A Museum, UNESCO City of Design status, and making a bid to the European City of Culture programme.

Dundee's videogames cluster further benefits from the industry's positive trajectory at a national and UK level. As of 2019, games and interactive technology companies across Scotland comprised 7.9 per cent of the UK's total games companies and 10.7 per cent of its staff (TIGA 2019). Also in 2019, the total gross value-added impact of Scotland's video games business was £352 million, or 6.9% of the UK total of £5.1 billion (BFI 2021: 233).

The industry bodies that support the Scottish games industry are of course available to Dundee companies. These include the Scottish Games Network, a focus for research, industry development, and information sharing, Creative Scotland, with its Scottish Government remit for development of the nation's creative industries, Scottish Enterprise for business support, research and business collaborations involving Glasgow, Edinburgh, Heriot-Watt, Napier, and the Highlands & Islands universities, and games worker organisations such as Girl Geek Scotland, and the Scottish Games Developer Association. Finally, UK-wide games industry organisations such as TIGA, Ukie, and Women in Games include Dundee in their ambit.

Challenges and Opportunities Facing Dundee's Cluster

By the 2010s Dundee was displaying the energetic although not always coordinated features typical of creative clusters (Mateos-Garcia and Bakhshi 2016). A UK boom in independent studio start-ups during 2010-13 added enthusiasm and youth to the Dundee cluster (TIGA 2013, Mateos-Garcia et al 2014), but was curbed by a lack of leadership and expertise to guide strategic business development and support. This weakness coincided with high-risk opportunities and existential threats within the global context, such that within a few years, across the UK, there was nearly one games company exit for every start-up (TIGA 2019: 6). Dundee's larger, more experienced companies were not immune to these challenges, as illustrated by the surprise closure in 2010 of Realtime Worlds, Scotland's largest games studio at the time (150 employees), two months after releasing *APB*, a 6-year project, the exit was attributed primarily to poor project and financial management despite backing from a major multinational publisher (Stuart 2010).

Prior to 2018, the conditions challenging the Dundee cluster included several with national and global origins:

- **Technology disruption:** More accessible programming engines, digital games distribution through self-publishing platforms such as Apple's App Store, and the advent of social media networks such as Facebook becoming games platforms opened new markets and significantly reduced costs for developers to create and sell their products, particularly those serving the exploding market for smartphones and other mobile devices. While these conditions supported the rise of 'super-indies', or micro-sized independent developers, AAA developers of console games faced ever-rising development costs, to meet consumer demand for increasingly sophisticated features (Tsang 2021, Ukie 2020, White and Searle 2013).

- **Changing business models:** Before these disruptions, developers typically worked to a publishing model, in which games publishers provide royalty advances to support studios' development costs, possibly also sharing profits if games clear their debts. Publishers also develop their own games with in-house teams or pay fees to external studios to 'work for hire'. In these models the publisher carries the majority of risks, retains the bulk of profits and often the IP, making it difficult for contracted studios to resource their own IP development and scale-up efforts (Bakhshi et al 2010, Grewar et al 2015). As self-publishing became possible, indies switched to a platform model, where they often bootstrap (self-fund) costs, earning larger portions of any sales revenues. However, monetisation of games is not simple, and as product marketing within an increasingly saturated mobile market grew more difficult in the mid-2010s, studios sought financial stability via other models, making games for social networks, consoles, personal computers, and the emerging virtual reality/augmented reality field (White and Searle 2013). Yet these market models are volatile (TIGA 2019), and for individual cash-strapped micro and small enterprises, the costs of retooling and re-organising development could be prohibitive. As a cluster, Dundee's studios largely focused on the mobile market with some presence in the others (including ongoing publisher contracts) (Mateos-Garcia et al 2014).
- **Investment:** Market competition requires that developers answer consumer demands by continually advancing technologies, yet this increases the need to secure development finance (House of Lords 2023). While the publisher model provides funding and prestige from multinational publishers, project commissions dropped as indies moved to self-publishing. Studios could seek corporate investors such as banks, angel and venture funders, but as creative games development was poorly understood outside the sector, these investors viewed the sector as prohibitively risky (Bakhshi et al 2010). Reluctance to fund games companies is fading, but as of 2017 just 2% of UK games companies had attracted equity support, making the finance gap a chief cause of studio closure (TIGA 2019).
- **Brain drain:** As the market for games became global, the UK industry experienced an exodus of companies and talented workers to other countries, such as Canada, where games studios benefited from earlier government subsidies. This brain drain cost the UK games industry not only skilled games developers, but also their vital experience of navigating the industry, again contributing to poor studio sustainability (House of Commons 2011, TIGA 2012, Stuart 2012).

In Dundee, these sectoral challenges meant that to stay in 'the game', developers needed to respond to swift and substantial changes in audience trends, technological possibilities, and financial opportunities. The usual strategy was rapid innovation, whether of new games IP, adaptations for new markets, or new commercial models. But these responses required an elasticity that Dundee's micro and small companies, typically short on capital resources, research and development capacity and industry experience, found hard to sustain.

Lacking leadership to engineer greater stability for the cluster, particularly to investigate the above opportunities and challenges for SMEs, by the early 21st century Dundee's videogames sector risked losing momentum, vitality, and the ability to future-proof itself for success.

However, a substantial opportunity to tackle these problems arose in the Arts and Humanities Research Council's Creative Industries Clusters Programme (CICP). Key cluster stakeholders worked to undertake a preliminary mapping of the cluster challenges, identifying the cluster's viability hinged on addressing three mutually impacting needs:

- **Creative risk:** Dundee studios need support that optimises creative experimentation and preparation for investment, such as leading-edge, low-risk model prototyping and testing, and greater exposure to investment sources. IP development offers potentially high-value returns, but this is speculative work, carrying high financial risk. Ever-advancing technologies offer infinite creative opportunities, but are costly to research, develop and test. And thanks to the 'nobody knows' factor typical of all creative industries, the inability to accurately predict eventual market success—to gauge what will be viewed as compelling entertainment, an ultimately subjective judgement-- hampers efforts to attract investment (Bakhshi et al 2010, House of Commons 2011, Caves 2000, Tsang 2021). Thus, the leading cause of games company failure is developers using up their limited finance before advancing products to market release (TIGA 2019).
- **Business organisation:** Cluster companies need more formal approaches to organisation and stronger commercial capacities, supported by resources and expertise in business modelling, financing, organisational design, and knowledge growth. While typically motivated by the intrinsic rewards of creating products for play, start-up and micro developers' passion yet minimal entrepreneurial experience can skew their efforts to scale up operations, let alone withstand the industry's buffeting trends.
- **Diversifying and exploiting innovation:** With insufficient capacity to advance ideas from concept to market, or to recognise that technologies or processes developed incidentally to games may have exploitable value, studios miss opportunities to expand to secure business viability. Dundee's developers need support to identify innovations with commercial potential and the new markets they could serve, including arenas beyond games where games design and technology could be fruitfully applied. Once targeted, companies need help in developing business plans, investment pursuits, platform targeting, and monetisation strategies.

Cluster stakeholders further distilled consultation findings into a single aim: To increase the scale and value of the Dundee videogames cluster through collaborative research and development. To achieve this, the team proposed and successfully won CICP funding for InGAME, a Dundee cluster for Innovation for Games and Media Enterprise. The next chapter explains how InGAME organised itself to work with the cluster to reach this goal.

Chapter 3

Organising InGAME

In this chapter, we explain how InGAME organised its approach to growing the Dundee videogames cluster's scale and value. Here, scale means growing the number, size, intensity, and sustainability of cluster enterprises, while value is seen as both financial and non-economic, the latter including capacities to innovate intellectual capital, to effectively organise resources, and to capitalise on connections and opportunities within and beyond the cluster. *Table 3.1, InGAME Delivery Inputs*, illustrates InGAME's means of delivering these, via its cluster partnership, strategic work themes, and an operations Engine, as described below.

Table 3.1, InGAME Delivery Inputs

Cluster Partnership: Collaboration	Strategic Work Themes: Meeting cluster needs	Strategic Delivery Model: The Engine
Academic expertise and funding	De-risking creative experimentation and commercialisation	Collaborative R&D <ul style="list-style-type: none"> • Innovation Vouchers • Applied Games Labs • Challenge and Open Calls • Pathfinder research
Local, national and international industry expertise and funding	Developing scale-up capacities and organisational capabilities	
Public sector (Scotland and UK) expertise and funding	Diversifying and incentivising innovation opportunities	Cluster Capacity Development <ul style="list-style-type: none"> • skills training • incubator activities • network activities • evidence/analysis/dissemination • industry fellowships
CR&D Centre facilities		Innovation Challenges <ul style="list-style-type: none"> • Applied Games Labs

Building for Growth and Innovation

Cluster Partnership

The partnership comprising InGAME was cemented and resourced in 2018-2019 with the appointment of full-time staff including a Project Director, Project Coordinator, eight Research & Development Fellows (R&DFs), a Producer and a Technician. Along with higher-education faculty researchers (InGAME Co-Directors and Co-Investigators) from the universities of Abertay, Dundee, and St Andrews, these managers, researchers and technicians provide knowledge from their diverse disciplines and research experience to address cluster challenges. The many InGAME projects described in this report have benefitted from their expertise in:

- animation, narrative and storytelling
- audience insight/user testing
- business model innovation
- creative economy & collaborative networks
- design thinking/service design
- data-driven design
- entrepreneurship and intrapreneurship
- experimental game development
- game production process
- interactive engagement
- management & leadership
- organisation design & development
- performance and play
- sound design and composition
- equality, diversity and inclusivity
- technology innovation and diversification

A core element of project delivery is InGAME's partnerships with industry and public sector organisations, contributing experience in commercial games and technology development and organisational capacity development. Along with academic partners, these organisations guide InGAME by serving on governance and operational committees, and help stage and subsidise innovation challenges, business accelerators, emerging technology testbeds, and capacity-building engagements. These partnerships provide a flexible, efficient structure for InGAME's collaborative R&D, their resources deployed through short-life projects co-ordinated by the CR&D Delivery Team.

The versatility and flexibility designed into the project was originally supported by a physical hub, Dundee's Vision Building, which served as a collaborative working and exhibition space. Networks amongst cluster members were fostered in this space, knowledge shared, ideas generated and the R&D activities housed. Although the physical space was vacated during the COVID-19 pandemic, the strong relationships established in the early phases of the project translated to the online environment with minimal disruption to aims and activities.

Strategic work themes

An early priority for InGAME was to translate its vision into a strategic programme to be delivered by the partnership. The following three themes (*Table 3.1*, column 2), informed by early scoping work (Anderson 2020), capture InGAME's goals within practical foci that drive daily delivery and organise the R&D activities:

- **De-risking creative experimentation and commercialisation:** Pursuing speculative development in-house generates costs that may never be recouped if products fail in the market, or never arrive there. This theme prioritises assisting SMEs to explore higher-risk and higher-value ideas of products, services and processes, via low-cost model prototyping and testing.
- **Diversifying and incentivising technology innovation:** Expanding products or services is one way to secure business sustainability and growth. InGAME interventions help companies to develop disruptive solutions and to identify and extract exploitation possibilities in technical and process innovations that have potential value as products or services.
- **Intensifying scale-up and organisational capacities:** InGAME uses R&D, business skills development and service design to grow SME commercial capabilities, diversity, resilience and investment readiness. For the cluster, InGAME engages investors and external collaborators to develop new opportunities and applications for games product, service and experience innovations.

InGAME Engine

Implied in the above themes is the need to deploy a substantial and effective research and innovation infrastructure, known as the InGAME Engine. Further oriented by the InGAME aims and objectives, the Engine is a dynamic means of surfacing and responding to opportunities and challenges as cluster companies, partners and other stakeholders co-design, adapt and deliver R&D interventions, realising outcomes for individual participants while strengthening general cluster capacity. Crucially, the Engine promotes scale and value and hedges the risk in creative experimentation, diversification and intensification for SMEs, while forging new modes of industry-academia collaboration.

Here we describe the Engine's three strategic operations foci (column 3 in *Table 3.1*), Collaborative Research and Development (CR&D), Cluster Capacity Development (CCD), and Innovation Challenges. While set out as discrete elements, in practice these activities, their purposes and participants often overlap, while the insights and outcomes they generate drive InGAME's continual innovation of topics and methods for cluster engagement.

Collaborative Research and Development (CR&D) is research-led innovation and knowledge transfer with companies that support R&D practices. CR&D takes a variety of forms, described below, which have been developed from models founded in national CICP practice. InGAME deploys these adaptively to suit the varying needs and resources of creatives and other sector participants working in or with the Dundee games cluster. A strategic innovation flow (see page 25) maximises CR&D impact by identifying cluster opportunities and needs, leading to co-design of interventions that provoke, de-risk and iterate creative ideas to create value.

InGAME has developed the following modes of CR&D:

Innovation Vouchers are the primary route for engagement with InGAME. These competitive, non-monetary awards provide expertise, technology and services to rapidly prototype, de-risk, and further develop new gaming products, services, technologies and business models, thus driving innovation and growth. Voucher recipients retain resulting IP, which they may seek to exploit via partnerships or investment brokered by InGAME. Applications are invited via Open Calls for ideas with innovation potential, or in response to Challenge Calls or Applied Games Labs promoting specific innovation briefs. Applications are administered by InGAME partner Interface, an organisation that brokers and manages collaborative projects between businesses and Scottish universities and research institutes.

There are two types of voucher:

- **Prototyping vouchers** support participants to identify development requirements and generate proofs-of-concept for their ideas. The vouchers provide up to the value of £5,000 of InGAME resources, while recipients match the awards in-kind. The application process is itself interactive and productive, with co-designed Discovery Labs to validate applicants' innovation ideas and alignment with InGAME objectives and resources. Examples of innovation voucher projects are described in Chapter 4 (see Agri-EPI, Scottish Games Network, and TPLD cases).
- **Follow-on vouchers** support further development of viable prototypes with awards of up to £25,000 in R&D value, while recipients match with 20% in cash and 80% in time. In these projects, InGAME helps recipients advance innovations toward future investment or commercialisation, often facilitating collaboration with industry partners. Such projects typically focus on technical or business model development, market analysis, or platform assessment. See Chapter 4 for vouchers won by Floyen and Lowtek.

Applied Games Labs (AGLs) are multidisciplinary events challenging industry experts, SMEs and academics to prototype responses to wicked problems and opportunities. At the same time AGLs de-risk games companies' experimentation and commercialisation, stimulating diversification in products and services. The AGL methodology, described on page 26, has been iterated throughout the InGAME project, becoming a primary focus in the latter stages of CR&D delivery. For examples of AGL projects, see the cases beginning on page 51.

Challenge Calls are co-produced by InGAME and industry sponsors as competitions provoking SMEs to respond creatively to emerging problems or opportunities in the games and media sector, simultaneously advancing the cluster's diversification and growth. Through prototyping, mutual learning and knowledge sharing, all competitors benefit as they advance their ideas. Winning prototypes may be further supported with follow-on funding and investment. An example of a Challenge Call is the Inclusive Design for Immersive Experiences Challenge, sponsored by StoryFutures Academy, Open Inclusion and XR Access (see page 32).

Pathfinder or Demonstrator projects are extended research and knowledge-transfer engagements in which R&D Fellows are embedded within cluster companies or contexts to understand challenges and co-design strategic responses. An emphasis on multi-directional knowledge transfer results in learning that is shared with the cluster in the form of best-practice guides, masterclasses, playbooks, and toolkits (see innovationforgames.com). For an example of a Pathfinder project, see the Outplay Entertainment case, page 41.

Cluster Capacity Development (CCD) is the second category of strategic Engine operations. These network, skills, and knowledge activities enhance SMEs' creative, technical and organisational capacities while enabling InGAME partners and participants to share intelligence and iterate future engagement modes. CCD activities are delivered by InGAME or partners with unique skills, networks and other resources which enhance the mutual benefits generated.

Talent, Skills and Incubator activities enhance participant capacities through training and masterclasses. Activities include business development, platform or technology training, and mentoring. Examples include InGAME's remotely delivered incubation programme for the UK Games Fund graduate competition, Tranzfuser, and the sponsorship of cluster members to attend training by InGAME partners Creative England (see Tag Games case, page 45) and V&A Dundee Design for Business. For academics, InGAME provided professional development training, delivered virtually in 2021, in collaboration with researcher-training company Electv. Given the events were not limited by typical capacity issues of in-person events, InGAME was able to open the workshops to academics throughout Scotland and the national CICP network. In total, InGAME training activities benefitted 2,283 professionals, more than 3.5 times the target figure (BiGGAR Economics 2023).

Cluster Diversification and Development brings together InGAME partners, cluster members and creatives in adjacent industries to share intelligence and skills and provoke action. These network events also create opportunities for redesign and reorientation of the InGAME Engine and its collaborative R&D mechanisms. An illustration is the experimentation space provided in 2020 by the Biome Collective's Arcadia Nights, where InGAME researchers and partners experimented with virtual engagement in the face of COVID-19 restrictions. Before video-based meetings and virtual workshops became commonplace, participants supported each other in exploring the possibilities and challenges of platforms that supported these new ways of working and enjoying creative meetups. Another example is the InGAME Insights programme of events curated by partner Creative Dundee. These periodic events, held online or in-person, foster cross-sector engagement and knowledge-sharing, and inspire equality initiatives for the games cluster.

Showcase and Investor events present the innovative proofs of concept for products, services and experiences which have been generated through CR&D projects to potential development and financial partners. The events promote intelligence-gathering and commercialisation by exposing cluster products to market investors, publishers, commissioners and platform holders.

Evidence, Analysis, and Dissemination activities are central to InGAME's cluster support as a centre for industry-leading research and development in collaboration with academia. Data and insight produced by InGAME, for instance supporting understanding of R&D processes, technology, the industry and best practices, is shared through various channels to inform current and future activity and to support evaluation. For a list of Selected InGAME Publications, see Appendix.

Innovation Challenges is the third strand of strategic operations within InGAME's Engine. Informed by deployment of the above elements and delivered primarily through the Applied Games Lab (AGL) process, innovation has become a significant focus as InGAME's delivery programme has advanced. In parallel with developing a theory of change about how games technology is transforming the future, InGAME has iterated the AGL (page 24) with increasingly external and ambitious themes and more dynamic CR&D activities. Co-produced with industry partners, these events catalyse participant ambition and creativity in response to wicked problems and technology opportunities within and beyond the sector. The AGL often makes use of CR&D interventions such as Open Calls, Challenge Calls, and Demonstrators.

Iterating InGAME

InGAME launched its delivery programme in 2019. In Year 1, the focus was piloting CR&D and cluster activities and establishing project management routines. Borrowing techniques from games development itself, particularly agile and scrum methods, InGAME's programme direction began working in periodic loops enabling continuous, strategic reflection and adjustment. These involve evaluating each intervention in real time, learning from and sharing results, while also scanning cluster and sector horizons for disruptions and opportunities. Insights gained from this process (see below for staff reflections) drive the iteration of strategy and method as necessary, resulting in responses that nurture cluster member capacities, ambitions and innovations as appropriate to context.

This adaptive management enabled InGAME to react swiftly and effectively to legislated requirements to work from home during COVID-19, beginning in March 2020, while adjusting CR&D engagement. InGAME staff and partners excelled in adapting distributed working methods, experiencing an increase in CR&D output during the 2020-2021 period. As restrictions against office working in Scotland were removed in March 2021, InGAME commenced working in a hybrid manner to optimise work and engagement methods afforded by both in-person and virtual meetings, as project and personnel needs dictated. This approach has continued to be deployed and refined as the programme has continued.

Evolving an Engine: Reflections from InGAME's Head of CR&D

InGAME's Engine is the particular focus of Chris Lowthorpe, an R&D specialist in production workflows. His remit is to identify innovation opportunities while guiding evolution of CR&D interventions.

Working with InGAME Director Sean Taylor, Chris continually assesses InGAME's strategy and its ability to meet SME needs, ensuring each engagement develops the cluster by enhancing its collective value-creation capabilities and sustainability.

Borrowing a term from software development, Chris likens the approach to continuous re-versioning of the operating system (OS) that controls the InGAME Engine: 'It's analogous to software design due to its adaptive mutability, continuous beta state and improvement. Think of it like a modern car engine run by an OS on chips. The Engine is the activities driving innovation and R&D, and the OS is the designed system that enables and controls it.'

To ensure the Engine serves the cluster effectively, Chris, Sean and colleagues continuously 'design, deploy, break and iterate the OS', paying particular attention to strategic elements and how methods of thinking, working, and learning support and challenge the strategy.

A few stages illustrate the Engine's evolution, one being the structuring of innovation flow within CR&D engagements. As the team reflected on an initial year of piloting delivery models in Spring 2020, the COVID-19 pandemic necessitated distributed teamwork for both InGAME staff and project participants.

These events sharpened thinking about how the Engine could be adjusted to ensure effective use of InGAME's finite resources.

'COVID-19 was a forcing and learning function. In many ways it allowed InGAME to get more productive, more asynchronous, more delivery-focused, and to leverage its core people better and move faster to deliver value. Sure it also presented challenges, but we adapted fantastically well,' Chris said.

An innovation flow or pipeline is a process typically applied to product development, where it structures the identification and acceleration of ideas for products and services. InGAME uses the idea to improve SME experience of CR&D engagement, beginning with applicant selection. Better filtering of projects, through Diagnosis and Discovery Labs in which applicants and InGAME pinpoint innovation opportunities and chart their CR&D pathway in alignment with InGAME strategy, improve InGAME's return on investments.

InGAME sees attention to innovation flow within each form and stage of CR&D as advancing the usual models of industry-academia collaboration, blending academic rigour with industry speed to amplify achievements. 'Innovation flow enables us to make smarter bets with InGAME resources and deliver support that is truly additive to the companies and entrepreneurs we work with,' Sean explained.

Attention to flow helps InGAME identify applicant needs, such as strengthening entrepreneurial capacity to capitalise on product design acceleration. Business training for SMES, such as that provided by Creative England / Ukie and V&A Dundee Design for Business, is now central to some CR&D. Innovation flow extends impact beyond InGAME, ensuring participants can continue planning and pursuing capacity improvements to advance their futures.

InGAME's learning and evolution continue informing development of its model. Looking back, it is inevitable the priorities and knowledge emerging from InGAME's evolutionary approach differ from those that sparked the original design of the programme. 'InGAME would no doubt be radically different if designed now from first principles, knowing what we know now. Some of it we guessed at the start, some we learned along the way,' Chris said.

Change for the Future

External shocks such as the pandemic, and InGAME's ongoing evaluation and response discipline, spelled a need to strategically confront the emerging problems and opportunities for the sector. The team was observing, across a range of industrial uses, how elements of games technology were being applied to real-world challenges.

"What we saw happening was that game technologies but also game design and practice principles were being applied way outside of any videogame. Whether that would be to air traffic control management in Hong Kong International Airport, to user interface systems for new electric vehicles, to the design of Uber as a service--it was taking it way beyond, disaggregating elements of games."

Chris Lowthorpe, InGAME Head of CR&D

These alternative uses of games technology constitute a step beyond making 'games for good' or 'serious games', which gamify learning or problem-solving activities yet still engineer them as entertainment experiences. Instead, the ambition is to create game development tools, processes and hardware which serve critical functions within everyday life experiences. Already, industrial digital twins and metaverse prototypes are using technologies and techniques that were either created by the games sector or validated there, such as real-time 3D game engines, workflows, and play-based experiences. With the internet advancing 3D content and innovators pursuing artificial intelligence applications, videogames technology can serve as an innovation sandbox for these developments.

Theory of change

Acting on these observations, Chris and InGAME Director Sean Taylor articulated a sharpened vision for catalysing change through InGAME's CR&D activity, re-imagining a future trajectory for games with a theory of change:

Game tech is transforming the world. We believe the creative application of game technologies and game design techniques can transform innovation, grow economies, and drive positive social change.

Shifting from games for entertainment, this vision, and its deployment through Applied Games Labs (AGLs), provokes solutions that apply games design and games technologies to wicked problems and grand challenges, such as the climate crisis, sustainable food supply and public health. Partnering public-sector and other organisations new to the videogames world, the strategy enables InGAME to support SME diversification and to position them in the vanguard of games technologies' expanding purview.

Applied Games Lab

By now refined as AGL 3.0, InGAME's innovation process proceeds with a 3-stage innovation flow, as in *Figure 3.1, InGAME Applied Games Lab 3.0, Innovation Flow*.

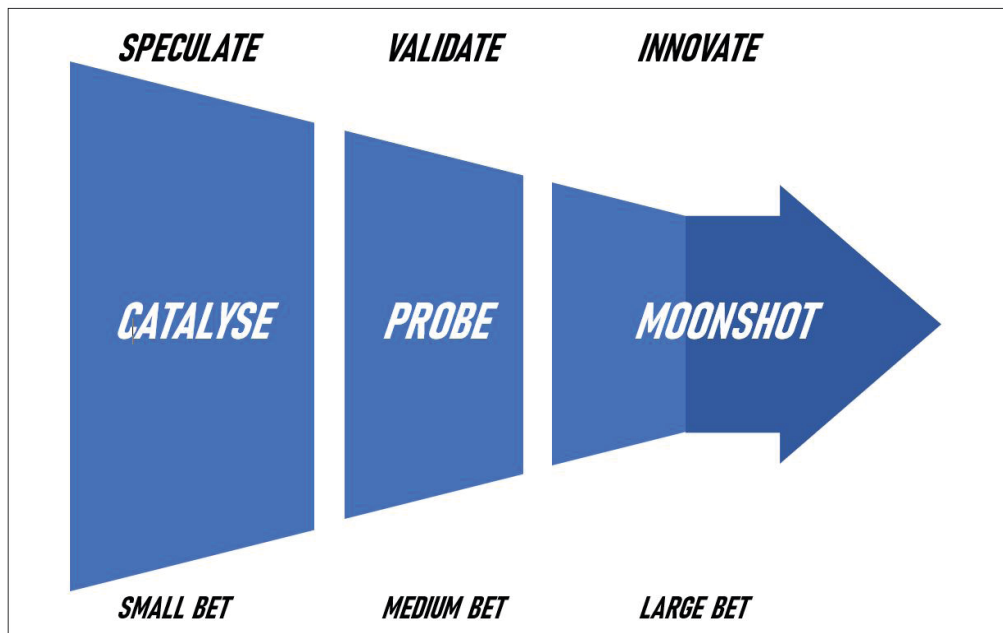


Figure 3.1, InGAME Applied Games Lab 3.0, Innovation Flow

Projects advance through as many of the AGL stages as are feasible given the goals and resources of sponsors and participants. The first step, Catalyse, is a foundational intervention (or ‘small bet’ in *Figure 3.1*), a gathering of developers and stakeholders who respond to a provocation of an imagined future by defining and exploring the problem and opportunities, then co-design radical, speculative solutions. The Dundee Sustainable Mobility project (page 51) illustrates the Catalyse stage. Stimulated by the need to reduce waste and increase effectiveness of transport, designers, gamers, technologists and sustainable mobility businesses contributed to a make-a-thon workshop. The result was *Imaginarium*, a pop-up display of design solutions to the city’s future transport needs, as a basis for consultation with local stakeholders.

Probe is the next step in the AGL process, a time-limited design exercise, or innovation sprint, to validate concepts, producing viable solutions ready for further iteration. This is a ‘medium bet’, as funding is provided to support SMEs to experiment creatively as they iterate prototypes to meet a challenge, simultaneously learning to expand diversification opportunities. This phase is illustrated by the SmARTview project with the dairy industry and Agri-EPI (see page 53), which sought ways to apply game technologies to improving cows’ health and productivity. After defining the problem and potential solutions, InGAME and Agri-EPI staged an innovation sprint to validate and prove market demand for a prototype that would combine farm data, artificial intelligence, augmented reality and user experience technologies. The resulting solution attracted £250K from Innovate UK for further development and trialling in the field.

Finally, the Moonshot step launches ambitious innovations into arenas where games technologies can transform the future. These projects involve significant partner investment and are thus the most high-risk, yet high-reward, AGL projects. This stage is exemplified by the Nesta Virtual Healthy Neighbourhoods project (page 56) and the resulting Playbox prototype, a synthetic sandbox for visualising the systemic challenge of obesity. The aim was to provide policy makers with a tool enabling them to 'play' with and test solutions before they are applied in real life, by harnessing big data, environmental simulations and other games technologies. Catalysing the project with a Challenge Call, InGAME advanced the project to Probe stage, with Nesta funding five SMEs to validate their solutions. In the Moonshot phase, the two most viable prototypes were funded to develop their Playbox prototypes, from which one solution was selected for development in collaboration with Nesta.

In 2023, InGAME continues to refine the AGL method and to further explore the value of InGAME's theory of change, particularly in forging solutions to public-sector challenges such as disaster planning, education, policy design and the creation of sustainable cities. An award from the AHRC-DCMS Creative Industries Demonstrator programme is supporting development and validation of AGL 3.0 and its potential for spinout through a national delivery programme.

InGAME also is extending its strategic work to de-risk SMEs' creative experimentation and commercialisation, and to develop scale-up and organisational capacities. In partnership with Scottish Enterprise, Scottish Development International and Creative Scotland, InGAME is working with Indielab Games UK Accelerator 2023 to deliver masterclasses, seminars, and networking opportunities to a select cohort of 10 to 15 emerging games companies across the UK.

Two further themes dominate during the final year of the AHRC InGAME CICP: evaluation and dissemination of its results, and legacy planning. Chapter 4 of this report illustrates many of these achievements through short case studies of projects, while adjacent reports (see innovationforgames.com) paint the picture of InGAME's economic impacts. Additional dissemination is being conducted throughout 2023 via showcasing events, such as the InGAME Arcade in the InGAME R&D Centre, presentations at South by Southwest media and culture festival in Austin, Texas, and the Games Developer Conference in San Francisco, California, and a public exhibition at Dundee Contemporary Arts.

InGAME continues to codify its collaborative R&D model, aiming to consolidate the process, and validate the model for potential transfer to other industry clusters as a cost-effective means of cultivating growth and innovation. If successfully extended and transferred, InGAME would play a role in growing scale and value more widely, while continuing its significant work in driving Dundee's world-leading research and innovation for videogames, interactive media and immersive technologies.

Chapter 4

Growing Scale and Value: Case Studies

The following project cases illustrate some of the 177 diverse projects conducted by InGAME and its partners. The cases are selected to illustrate how the cluster increased scale and value through its various intervention models.

DCMS : Loot Box Rapid Evidence Assessment

Intervention: Evidence, analysis and dissemination

InGAME Project Team: Darshana Jayemanne, Shiona Chillas, Jim Moir, Augusto Rocha, Fraser Simpson, Heather Wardle, CR&D Delivery Team

- InGAME was commissioned to undertake a rapid evidence assessment of loot boxes and microtransactions in video games at the request of the UK Department of Culture, Media and Sport (DCMS)
- The research combines InGAME's substantive academic expertise, gambling research and authoritative industry input, to address the primary question, Do loot boxes and microtransactions encourage problematic play behaviours?
- Concluded in March 2021, the report provides evidence to government, helps engage policymakers, informs policy debate, and sets an agenda for future research and data collection

Loot boxes, or reward devices inserted into games to keep players engaged, are not new. However, their increasing prevalence in digital games and the emergence of business models seeking to maximise their income potential have generated concern that they may constitute a form of gambling with potential harms for game players. Currently however, loot boxes sit outside UK regulation and there is a dearth of evidence-based understandings about them.

To fill the gap, the UK Department of Culture, Media and Sport (DCMS) launched a call for evidence. InGAME won the commission to conduct a Rapid Evidence Assessment (REA) for 10 weeks from February to March 2021. The research identified key characteristics of the loot box market, explored whether they encourage problematic play behaviours, and aimed to understand if and how loot boxes are associated with harms and what the drivers of harm may be.

Loot box as 'complex technological, legal, physiological, psychological and cultural event'

The review team was faced with unpacking a complicated games phenomenon. Games developers use different types of loot boxes within digital games, in different ways. Typically they are a form of randomised reward mechanism (RRM) which supports the game's market performance by incentivising users' continued play, structuring the release of new game content, and, where players buy the devices in order to advance through game levels, monetising the product. Loot devices are thus central tools with which game developers can build value in their IP.

Critics who compare loot boxes to gambling, however, see problems in 'sticky' design techniques that build players' desire to continue playing, the random nature of rewards, and the microtransactions--including in many games promoted as initially free to play--which players, especially, children, may misunderstand or forget as they race to unlock further game levels. There are further concerns about developers' use and possible selling on of user data, potential manipulation of rewards, and third-party trading of loot box rewards beyond developers' intentions.

To address this complexity, InGAME assembled a team of academics with expertise of gambling research and the games sector, to survey existing literature and identify where relevant information is established or missing. The team also gathered expert perspectives from InGAME partners within the Dundee cluster who are game designers and producers of children's media content.

The team analysed more than 280 research publications and found evidence that loot boxes used by the video games industry do indeed have correlations with problem gambling, while also establishing that research in this area is in its infancy. The completed report recommends further work should be undertaken to understand the positive and negative impacts the sector has on its customers, before legislation is introduced. The report also proposes a set of principles for ethical loot box design, based on the team's findings.

'At this stage it is important to take a cautious approach to regulation of loot boxes,' said InGAME lead author Dr Darshana Jayemanne. 'However, it also does not mean that nothing can or should be done. We advocate an expanded approach that incorporates consumer protection frameworks, affords a range of tools, and gives latitude for action,' while also considering the variety of games produced and their player populations' different risks. 'Our interviews with game developers suggested such an approach would be valuable, helping them to create better online communities, manage risk, and work towards new designs.'

DCMS has used the final report to supply evidence to government and inform policy debate. For InGAME, the REA commission provided an opportunity to harness its industry-based academic expertise to creating and disseminating knowledge about a technological and regulatory concern facing games markets worldwide. The project also enabled InGAME to set an agenda for future research and data collection on the challenges of loot boxes, and it has continued conversations with the DCMS on creating a research framework for improving the evidence base and establishing industry standards.

DCMS Rapid Evidence Assessment online:

Report download: [Loot boxes and digital gaming: a rapid evidence assessment](#)
([publishing.service.gov.uk](#))

<https://www.abertay.ac.uk/news/2022/loot-box-evidence-assessment-underlines-the-research-need/>

Hyper Luminal Games : Inclusive Design for Immersive Experiences

Intervention: Challenge Call

InGAME project team: Jen Ballie, Xinya Yu, CR&D Delivery Team

- InGAME worked with partners StoryFutures Academy, Open Inclusion and XR Access to deliver the Inclusive Design for Immersive Experiences Challenge, an opportunity for UK-based SMEs to advance skills in inclusive content development and business, thus growing their capacities and commercial ambitions
- 10 SMEs won £1000 each to attend an Inclusive Innovation Lab and to pitch for a place in the next stage
- Two SMEs, including Dundee's Hyper Luminal Games, won £35,000 each and places on the Inclusive Design Accelerator, to embed and test inclusive innovation concepts and user-centred features within their IP.
- Hyper Luminal has released its game, *Pine Hearts*, an open-world puzzle game, and is expanding its business with new staff and projects related to its inclusivity focus

Hyper Luminal Games is an indie games studio based in Dundee, developing both original IP and that of other companies through its work for hire. The company's ambition is to create 'games for good', having positive impacts on the world and providing enriching experiences for players. Founded by four games graduates of Abertay University, Hyper Luminal is one of the fastest-growing development studios in Scotland and now has more than 40 full-time staff. The studio prioritises robust development processes that 'make games better'. Included in this value, said Searra Dodds, Senior UX/UI Designer for Hyper Luminal, is an 'aspiration is to create a Hyper Luminal Standard of Excellence for inclusive and accessible games for all.'

Inclusive Opportunity

These priorities are what attracted Hyper Luminal to apply to the Inclusive Design for Immersive Experiences Challenge, a competition for UK-based SMEs in game or immersive development, run by InGAME, StoryFutures Academy, and Open Inclusion and XR Access. Through this intervention, the organisations aimed to speed up and democratise the adoption of inclusive design in games and immersive experiences, helping developers make the content accessible for a wider audience while extending the quality and reach of their IP.

Inclusive design improves the reach, user experience and consistency of immersive experiences. Immersive content is any experience that engages people in virtual, simulated or augmented realities. Content created with an inclusive design focus is more accessible and enjoyable to everyone, whether or not they have experiences of disability.

"We created the Inclusive Design Challenge to help develop confidence, understanding and capabilities in the practice of inclusive innovation for immersive content. Embedding inclusive design practices improves user experience quality, consistency and durability. It will ultimately empower companies to do better business by creating better things as well as creating immersive experiences that are enjoyable and accessible to everyone."

Fiona Kilkelly, Acting Head of Immersive, StoryFutures Academy

There were two stages to the Challenge: The Inclusive Innovation Lab was a four-day interactive programme designed to rapidly upskill SMEs in the practice of inclusive innovation and design. From a competitive application pool, ten SMEs were chosen and funded £1000 each to attend the Lab, where they learned to apply innovative approaches to designing, testing and delivering immersive content that provides better experiences for all. Attendees then pitched projects for inclusively improving their existing, near-to-market products, to be selected for the next stage.

For the Inclusive Design Accelerator, two teams from the original ten—including Hyper Luminal and its game *Pine Hearts*--were selected for an eight-week programme in which they embedded and tested inclusive innovation concepts and user-centred features within their IP. The companies were each awarded £35,000 to work alongside InGAME and Open Inclusion experts to advance their inclusive games as well as business competencies in strategy, communication, and investor readiness.

Hyper Luminal has since completed development of *Pine Hearts*, an open-world puzzle game, which is now available to download from Steam. Going forward, the company is embedding the skills and processes from the Accelerator into the foundation of its development process, to impact all future work. It is also expanding its business with new staff and projects related to its inclusivity focus, Searra said.

“With this fantastic opportunity from InGAME, we will be able to focus efforts on improving our internal communication and guidelines around inclusive design, allowing us to build better pipelines and processes, which include vital user testing and feedback with inclusive communities. We will also invest time in including more diverse characters, stories and customisation options into Pine Hearts, so players of all backgrounds can feel represented in the story. All of this will be supported with an innovative in-house accessibility toolkit which we hope to improve sustainably from project to project.”

Challenge Partners

InGAME partnered StoryFutures Academy, Open Inclusion and XR Access to deliver the Inclusive Design for Immersive Experiences Challenge. StoryFutures Academy is the UK's National Centre for Immersive Storytelling, run by Royal Holloway, University of London, and the National Film and Television School, and funded by the Arts and Humanities Research Council of UKRI. The Academy develops cutting-edge creative training and research programmes to ensure the UK creative workforce is the most skilled in the world in the use of virtual, augmented and real-time production technology for immersive storytelling.

Open Inclusion is an inclusive insight, design and innovation research agency based in London and operating globally. It was founded in 2015 to help organisations identify opportunities to design better experiences that work more consistently for all, through pan-disability and age-inclusive community engagement and research.

XR Access is a research consortium based at Cornell Tech, New York City, founded in 2019 to develop a community that creates and shares knowledge leading to practices that make XR (virtual, augmented, and mixed reality) inclusive of all, regardless of abilities.

Hyper Luminal Games: Inclusive Design for Immersive Experiences online:

hyperluminalgames.com

InGAME video about Hyper Luminal Games and the Inclusive Design for Immersive Experiences project: <https://vimeo.com/726090183/8b9356e2b0>

<https://www.innovationforgames.com/2022/03/01/ingame-launches-inclusive-design-for-immersive-experiences-challenge-call/>

<https://www.storyfutures.com/>

<https://openinclusion.com/>

<https://xraccess.org/>

InGAME Fellows : *Euphonia*

Advancing Research Skills through Collaborative Game Design

Intervention: R&D Fellows - Horizon research

InGAME voucher team: Lynda Clark, Jung in Jung, Stuart Anderson, Paul Blackham, Divij Sood, CR&D Delivery Team

- A multi-disciplinary team of InGAME research fellows created a prototype AI-powered voice-controlled narrative game, *Euphonia*
- Team members developed technical skills related to their individual research areas and improved InGAME's capacity to work with local cluster companies to build value within their own innovation challenges
- Learning from the project has been captured in a Narrative Design Toolkit (see innovation-forgames.com)

Much of InGAME's research activity is industry-led, with researchers utilising their specialisms to undertake R&D activities alongside and in collaboration with industry partners. However, finding opportunities to further develop the necessary skills for these activities can be difficult due to the niche practice-based nature of the research specialisms. Developing creative techniques and processes which rely heavily on new and emerging technologies is particularly difficult. In this project, InGAME colleagues developed individual skills and experience while testing and validating processes and workflows, and creating exemplar works for further study and demonstration.

"Euphonia began as my individual exploration of AI-powered narrative design techniques. But it quickly became clear that a collaborative approach was needed in order to fully exploit the emergent technologies in use."

InGAME R&D Fellow Dr Lynda Clark

Research Fellows with backgrounds in music, 3D art, and programming joined Lynda, whose expertise is in creative narrative and play. Together, they built *Euphonia*, loosely based on Joseph Faber's 19th-century automaton of the same name.

Through online co-design sessions and asynchronous team discussions, the project became an opportunity to explore not only narrative design, but also spatial sound, AI systems integration, 3D modelling techniques and text-to-speech technology. Each element allowed research team members to develop their own creative and technological practice, while also fostering processes for remote working and collaboration during the COVID-19 pandemic.

Exploring the design, structure and development of AI narratives via this experimental, practice-based approach helped InGAME to enhance the value of local cluster companies' own innovation challenges. Lowtek's application of text-to-speech technologies (see page 39) were de-risked through the direct application of learning from *Euphonia*.

The project's key outcomes include insight into game development methodologies which aide collaborations with industry in terms of project scoping and delivery, development and refinement of processes for synchronous and asynchronous remote collaboration, and a narrative design toolkit (see innovationforgames.com). The team also presented a paper and video detailing design of the work-in-progress game, to the 2020 international Symposium on Computer-Human Interaction in Play conference.

Euphonia **online:**

<https://vimeo.com/603949891>

Euphonia | Extended Abstracts of the 2020 Annual Symposium on Computer-Human Interaction in Play (acm.org): <https://dl.acm.org/doi/10.1145/3383668.3419913>

InGAME Fellows : *Sound of Light*

Intervention: R&D Fellows / Horizon research

InGAME Project Team: Jung-in Jung, Paul Blackham, CR&D Delivery Team

- In *Sound of Light*, players use the Oculus Quest headset and hand tracking feature to trigger sound production with body and hand gestures
- Development of the project has enabled team members to advance practical skills and knowledge regarding virtual reality, improving InGAME's capacity to work with local cluster companies with their own innovation challenges. Applications of the innovation are being considered further.

Sound of Light began as a series of explorations by InGAME Research & Development Fellow Jung-in Jung, using the Oculus Quest virtual reality (VR) headset to assist sound creation in virtual spaces. As a musician and sound composer who was interested in ways of creating interactive music, Jung-in saw in VR an opportunity to compose music in real time, through body movements and gestures tracked by the Oculus system, rather than using typical game controllers.

Extended reality

Jung-In's first production with the medium was *Hot Summer Afternoon*, a single-player environment where users created music within worlds constructed by InGAME 3-D game artist and Research Assistant Paul Blackham. Triggered by hand gestures, players perform music over a provided sonic backdrop. Jung-In calls the resulting musical experience 'extended reality'.

Jung-in was preparing to showcase the programme in 2020 in New York City and elsewhere when the COVID-19 pandemic prevented gathering with other people. However, this frustration and the loneliness of lockdown sparked a turn in her work, as she aimed to develop a new version where she could invite others into a virtual space to create music with her.

Again working with Paul, Jung-In developed *Sound of Light*, a multiplayer sound performance which onlookers experience as sounds that can be both seen and heard. In this prototype, inspired by playing multiplayer games as mute characters, Jung-In was concerned with how 'performers' of the music could communicate anonymously and non-verbally, as avatars who do not speak. Sounds are generated as players make different gestures, often directing them at other players in the virtual space.

This exploratory interaction, Jung-In has found, suggests the significance of *Sound of Light* may reach beyond her initial intention, to extending thinking about how VR might help us to bridge communication gaps when the usual visual and verbal cues are unavailable.

"I think the beauty of this project is just really to express yourself through sound and using your natural hand gestures. So it doesn't matter how you look. I mean, the avatar is very simple. So it's all about just sharing that experience together."

Jung-In Jung (scottishgames.net 2021)

The potential in *Sound of Light* is attracting attention. Jung-In has demonstrated it at various in-person and virtual games and media events and in 2022, it featured in a BBC TV series, *Martin Compston's Scottish Fling* (Episode 3, 'East Coast').

For InGAME, the project has enabled team members to advance practical skills and knowledge regarding virtual reality, improving InGAME's capacity to work with local cluster companies with their own innovation challenges. Applications of the innovation are being considered further.

Sound of Light **Online:**

Video demonstration and background: <https://www.junginjung.com/soundoflight>

Article: <https://scottishgames.net/2021/03/02/playaway-jung-in-jung-sound-of-light/>

BBC iPlayer – *Martin Compston's Scottish Fling* – Series 1: 3. East Coast: <https://www.bbc.co.uk/iplayer/episode/m001cc4g/martin-compstons-scottish-fling-series-1-3-east-coast>

Lowtek: Dislectek

Intervention: Innovation voucher: Prototyping

InGAME voucher team and case study authors: Stuart Anderson, Ruth Falconer, Jung In Jung, Naman Merchant, CR&D Delivery Team

- The Dislectek text-to-speech plug-in tool improves games access and experience for dyslexic players
- InGAME de-risked experimentation and testing of Dislectek, leading Lowtek to create valuable new IP and release it on the Unity Asset Store.
- InGAME created conditions for an early-stage venture to grow, facilitating potential collaborations and further scale-up. Lowtek received £25K from the UK Games Fund to support further prototyping, was accepted onto the V&A Dundee Design for Business Accelerator, and the British Film Institute-funded Accelerate: Games Programme
- Dislectek won the Scottish Games Award 2022 for Best Tools and Technology
- Lowtek has since released Flea Jump, a game using the Dislectek tool

Lowtek Games is a Dundee studio founded by Alistair Low, a graduate of Abertay University, which specializes in retro games for current platforms. Alistair secured an InGAME Innovation Voucher to validate the feasibility of a text-to-speech tool, *Dislectek*. The tool is a plug-in that works within the game engine Unity, one of the most widely used engines, to make games more accessible for dyslexic players.

"I wanted to create a prototype that could be shown to investors and raise awareness of the issues dyslexic players in the games industry have. InGAME's support increases the viability of the project."

Alistair Low, founder, Lowtek Games

While the game industry is striving to be more accessible and inclusive, there is a lack of solutions for dyslexic users such as Alistair, who struggle to read game texts such as dialogues, tutorials and item descriptions. Prior to this project, Lowtek created the experimental game *A Familiar Fairytale*, to increase players' awareness of the challenges facing dyslexic players, by simulating the frustration of reading text. *Dislectek* emerged as a development of this idea, envisioned as a plugin that could be easily integrated at any stage of the game development process, minimising the disruption to game developers.

Innovation Voucher

Working with Lowtek's design and art ideas, the InGAME team investigated technical challenges and helped Lowtek create a prototype of what would become the *Dislectek* tool. InGAME also supported user testing, recruiting game developers and end-users through InGAME's network, Abertay University's accessibility group, and Dyslexia Scotland. Developers praised the plug-in for its simple game integration and users valued its ability to select specific text areas, an improvement on other text-to-speech tools, which read the entire text on a screen.

The voucher project benefitted InGAME by challenging researchers to make its own communications more accessible and less text-heavy, inspired by Lowtek Games' communication methods. Further, the voucher's launch during the COVID-19 pandemic forced InGAME to design intervention methods that suited the period's remote working and testing environments, thus advancing InGAME's own research into remote user testing.

The Future

InGAME's voucher and follow-on support created conditions for Lowtek's early-stage venture to grow. InGAME facilitated potential collaborations for Lowtek and promoted further scale-up support from network partners. The company was awarded £25K from the UK Games Fund to support further prototyping, was accepted onto the V&A Dundee Design for Business Accelerator, an immersive programme to support new ways of problem-solving and thinking to support innovation in organisations, and chosen for the Accelerate: Games Programme, part of the BFI-funded creative enterprise programme to support early-stage game developers and games technology companies.

Following the InGAME voucher, Lowtek incorporated *Dislectek* into its own IP, then launched a commercial version on the Unity Asset Store in 2021. In 2022, *Dislectek* won the Scottish Games Award 2022 for Best Tools and Technology. Lowtek has since released a new game using *Dislectek*, *Flea Jump*. With further growth planned, Lowtek has positioned itself to continue innovating to make its accessibility-focussed products industry-standard solutions.

Lowtek : *Dislectek* online:

<http://lowtek.co.uk/Dislectek.html>

<http://lowtek.co.uk/FleaJump.html>

<https://assetstore.unity.com/packages/tools/integration/dislectek-192133>

<https://scottishgames.net/2021/04/15/make-your-game-more-accessible-with-dislectek/>

<https://www.innovationforgames.com/ingame-projects/dislectek/>

Outplay Entertainment : Flexible Hybrid Work Model

Intervention: Pathfinder embedded research

InGAME voucher team: Stuart Anderson, Mindy Grewar, Xinya You, CR&D Delivery Team

- InGAME worked with the UK's largest mobile game developer to research and co-design a post-pandemic model for hybrid working. The result enabled Outplay to scale up during the pandemic, hiring 15-20 people and retaining a further 65-70 staff who sought alternative work arrangements.
- Collaboration enabled InGAME to develop an open-access hybrid working model playbook (see innovationforgames.com)

The COVID-19 pandemic irreversibly changed the way people work, expanding the imagination of how organisations will operate in the future. In this context, Outplay Entertainment, Europe's largest independent mobile games developer, decided to transform its Dundee office-based operating model into a hybrid one, where employees typically work in both office and remote locations. Its primary goals were to give its 120 staff, known as Outplayers, flexibility in choosing their work locations, to make Outplay a better place to work, and to help the business adapt to COVID-19 disruptions. However, these aims were set just a few months into the pandemic, when there were few exemplars of hybrid organisations and none that accounted for employee and organisational needs in the context of a global health crisis.

Given these complex requirements, Outplay partnered with InGAME to benefit from its expertise in organisational design, management, and design thinking. A Pathfinder embedded research project was planned to help Outplay realise its ambition of pioneering a post-Covid hybrid operating model, with staff at all levels involved in its design.

The project was divided into four phases. In Phase 1, InGAME sought to identify staff needs and aspirations in relation to the future work model. R&D Fellows analysed surveys conducted by Outplay early in the work-from-home period, then interviewed 53 Outplayers one year after the pandemic began. In Phase 2, qualitative insights from the first phase became innovation triggers for a Collaborative Design Sprint (CDS), a co-design process engaging multiple stakeholders. The CDS supported participants to ideate optimal work processes and conditions within hybrid operations, while upholding core principles identified in Phase 1. Results were refined into a prototype for Outplay's future hybrid operating system.

In Phase 3, InGAME used the prototype to develop Flexible Hybrid, a work model complemented by quantitative objectives and key results (OKRs) for measuring implementation. Together, InGAME and Outplay aligned the model with existing HR strategies and emerging management perspectives on remote and hybrid working. Outplay began rolling out its Flexible Hybrid model once government requirements for remote working were ended (in Scotland: March 2022). InGAME supported by identifying open-source tools and devising templates for questionnaires and OKR measurement at future stages.

Outcomes

For Outplay, the collaboration's outputs have provided invaluable knowledge. 'It was very, very helpful in informing and getting a handle on thinking about how hybrid might work', reported a senior manager. 'I think without that thought process, we probably would have defined something a bit too early,' possibly assuming a mostly-remote solution was required. However, the project 'allowed us not to do that, because ...with the feedback from the sessions that InGAME ran, [we] realized very much what the office meant to people.'

Flexible Hybrid shaped new ways of working which helped Outplay weather the pandemic's significant operational challenges. The company generated four original games since the start of the InGAME project and grew its staff numbers by 15-20, despite inevitable attrition as workers sought to change jobs to suit personal circumstances.

Flexible Hybrid's attention to worker location has especially helped recruitment, a senior manager commented: 'It is easier because we can hire outwith the UK. [It can be] much more complex but we are filling roles that we probably would have struggled with' before implementing the model.

For InGAME, the project stimulated extensive qualitative and action research, and the design and validation of a co-design approach with bespoke tools. These have been generalised for other users (see innovationforgames.com). In this way, InGAME is helping organisations innovate contextually specific hybrid operating models which are inclusive of employees' different needs while increasing company competitiveness in global markets.

Outplay online:

outplay.com

Outplay Flexible Hybrid referenced in Women in Games guide for employers: <https://www.womeningames.org/the-women-in-games-guide-building-a-fair-playing-field/>

Scottish Games Network : Scottish Games Ecosystem Building

Intervention: Innovation Voucher

Project Team: Paul Blackham, Augusto Rocha, Divij Sood, Xinya You, CR&D Delivery Team

- InGAME and the Scottish Games Network collaborated to identify challenges faced by Scottish videogame companies and to strategise future interventions to help the nation's sector grow in strength, diversity and value
- The project entailed a survey, data analysis and reporting, and a strategy workshop, using a co-design approach to engage multiple stakeholders in the design process
- 108 businesses participated in the survey and strategy sprint. Findings have informed further research conducted by SGN and its academic partners, which were presented to the Scottish Parliament in November 2022

In 2021, Scottish Games Network (SGN) and InGAME launched a collaborative voucher project to design a blueprint for building a stronger Scottish videogames sector. Recognising that while the nation's achievements in the sector are significant, it does not have an organisation providing collective representation for games developers and related companies, nor is there strategic focus at a local or national level, apart from the InGAME Dundee cluster example.

The voucher aimed to innovate solutions to these gaps, by using a co-design approach of engaging multiple stakeholders. The project consisted of four phases: initially, InGAME and SGN conducted a survey of the Scottish industry, asking participants to identify the main challenges and obstacles to working in videogames. The survey attracted 108 responses, representing freelancers, companies from micro to large size, and academics. InGAME then analysed the data to identify attributes of entrepreneurial ecosystems (Spigel 2017) within the Scottish sector. An ecosystems framework draws a systemic view of entrepreneurial activity, recognising that businesses are affected by both internal and external factors.

In the third phase, InGAME shared its survey analysis with SGN. It found ten elements that impact the quality and quantity of companies' work in Scotland:

- game makers lack entrepreneurial mindset
- the sector is scattered, needing a central hub and affordable desk space
- networking is insufficient among game makers, publishers, investors, and support organisations
- the national sector lacks high-profile leadership and role models
- game makers need favourable policies in terms of taxes, R&D credits, national insurance contributions, currency conversion, and support with business implications of Brexit and COVID-19
- beyond initiatives such as InGAME, there is little collaboration between academia and the games sector, with inadequate funding opportunities for such work
- public-sector support is insufficient, due to poor understanding of the sector and its commercial needs

- Scotland's games sector is highly competitive yet there are difficulties with entering international markets and connecting to potential clients, especially for young studios
- there is a skills and diversity gap in the local talent pool, while companies struggle to recruit from farther afield
- game makers of all sizes and stages struggle to access finance, and are too dependent on low royalties from publishers

InGAME devised a strategy sprint to respond to these challenges, recruiting 31 stakeholders to co-create a development blueprint for a stronger Scottish videogames ecosystem. Participants included academics, publishers, game studios, public funding bodies, venture capitalists, and support tool and tech providers. The following objectives were prioritised:

- Creating an online home for the games ecosystem in Scotland
- Producing a showcase event for the Scottish games sector
- Building partnerships across industry, academia, and public sector, as in the InGAME cluster
- Providing regular sector data to government, public sector and other industries
- Creating a means for sector leaders and academics to communicate more effectively
- Increasing business skills among graduates, new businesses and start-ups
- Increasing engagement between universities, colleges and industries
- Creating a group of founders and business leaders to provide mentoring and business help
- Liaising directly with Scottish Government's Economic Development Directorate to ensure the games sector receives support and can access funds

InGAME and SGN believe implementation of the Strategic Blueprint could have a significant impact on the Scottish video game ecosystem. These priorities and other findings of the InGAME voucher are informing further research being conducted by SGN, the University of Glasgow and the University of Stirling. A preliminary report of this latter collaboration (Mullen et al 2022) was presented to the Scottish Parliament in October 2022.

Scottish Games Network online:

<https://scottishgames.net/>

Tag Games : Creative UK Games Scale Up

Intervention: Innovation Voucher

Tag Games applied for InGAME support toward building organisational capacity. After attending the Creative UK Games Scale Up programme, Tag achieved:

- part of a £36m investment deal from US publisher Scopely
- increased headcount by 30% and changed company structure with senior hires
- expanded company management skills and network contacts

Founded in Dundee in 2006, Tag Games is a business-to-business mobile games developer with over 60 titles to its credit. These include its own games and commissioned work for some of the world's leading brand owners and entertainment companies, including the BBC, Channel 4, Endemol, Adult Swim, Nickelodeon, Mattel, and Sony Pictures. From the early 2010s the company also developed solutions for game services and data analytics, branded as ChilliConnect, initially in response to its own game development needs. Eventually these tools were opened to external customers and Tag spun out ChilliConnect as a separate entity in 2016.

This short period of significant achievements by Tag also brought many behind-the-scenes demands on its organisation. Marc Williamson, appointed CEO in 2018, determined a need for strategic enhancement of the company's structure and management skills. After applying to InGAME's voucher programme, InGAME negotiated access for Tag and another Dundee games company, Earthbound Games, to participate in the first cohort of the Games Scale Up programme, in 2020.

Delivered by Creative UK and games trade body Ukie, and supported by the British Film Institute (BFI) and The National Lottery, the 6-month programme of masterclasses and networking helps games developers, publishers and support services to develop and grow their businesses. Participants gain experience and expert guidance on writing and implementing scale-up plans for their organisations, while workshops and networking events further expand their skills, contacts and investor exposure.

"The programme gave me confidence in running the business. Having a safe space to chat with other founders in the same industry was really valuable to me as a new CEO."

Marc Williamson, CEO, Tag Games

Following Marc's participation in Games Scale Up, Tag expanded management skills within the company and re-organised itself to work on a single project with a lengthy lifecycle. It also expanded its networking with potential market partners. In 2021, Tag secured an investment deal with US publisher Scopely to co-create a massively multiplayer online game. Funding from the project enabled Tag to hire 20 additional staff, including senior positions, growing the company headcount by 30%.

Tag Games : Creative UK / Games Scale Up online:

tag-games.com

Games Scale Up: <https://www.wearecreative.uk/support/creative-enterprise/scale/games-scale-up/>

Scottish Games Network Podcast Interview with Marc Williamson, Tag Games: <https://www.youtube.com/watch?v=-DlbuMs95G8>

TPLD / Floyen : Tipperary

Advancing augmented reality to commercial reality

Intervention: Innovation Vouchers

InGAME project team: Divij Sood, Xinya You, CR&D Delivery Team

InGAME worked with the company and its spin-out through two Innovation Vouchers to help them grow scale and value. For the Dundee cluster, the results helped attract investment and strengthened its technological and commercial diversity.

- Voucher one prototyped and produced technical proof of concept for TPLD's augmented reality (AR) museum experience, *Tipperary*. Voucher two validated the market opportunity, customer base and business model for spin-out company Floyen to advance the product.
- The vouchers helped Floyen unlock investment of £100,000 and to partner a Dundee-based game studio to develop the product, growing further value for the cluster. Floyen now aims to be a global leader in delivering AR interactive, immersive tools
- *Tipperary* is now available for play on Android and in a permanent installation at Lochee Library, Dundee
- R&D Fellow Divij Sood's framework for the AR technology has been shared online for wider dissemination

A developer of game-based learning solutions, Dundee company TPLD applied to InGAME's Innovation Voucher programme to gain assistance with producing a technical proof of concept for its augmented reality (AR) museum experience, *Tipperary*. This product gives users insight into 1930s-era life, work and play in an area of Dundee known locally as Tipperary.

The voucher de-risked TPLD's prototyping of its technological innovation and helped it validate its market opportunity. While presenting its prototype to potential clients, TPLD realised the need for an AR development platform that could create and manage similar immersive AR products for diverse industries such as retail, travel, and education. The voucher gave TPLD the confidence to spin-out a new venture, Floyen, to fully capitalize on learning and insights.

"Finding [InGAME], an organisation that offered a vision of developing new technology into a business opportunity, as well as having the ability to de-risk our proposition by having it evaluated by an expert peer group, was very important. It gave us the confidence that the assumptions we are making are sound. It was a significant bonus that this facility was available on our doorstep."

Mike Garty, Director, Floyen

Floyen applied for a follow-on voucher from InGAME to identify and define the customer base and business model for the new venture. This learning enabled Floyen to secure a £100,000 investment and engagement from the educational and cultural sector, leading to new jobs and a development contract for Dundee company Konglomerate Games. *Tipperary* can now be played through a permanent installation at Lochee Library, Dundee, or on Android.

"We loved working on this game and it's a perfect example of how games can be used for bringing history and culture to life. Actually exploring and immersing yourself in the world allows you to learn and understand far more about a subject, area or time through games than any other media."
Konglomerate Games senior manager

In response to demand, Floyen is innovating a new AR platform that can be generalized and applied to further projects. The company is now well positioned to capitalize on these advances as it aims to be the global leader in AR interactive, immersive tools for global marketing agencies, digital learning organisations, and other partners.

"It was a great output. We have great plans for the future, with some local entrepreneurs interested in helping us shape the AR app, a number of third-party organisations with real interest, and we have active sales discussions"
Jim Piggott, Director, Floyen

For InGAME, the innovation vouchers enabled it to test and iterate a generalised business design approach and to advance skills in AR games design. R&D Fellow Divij Sood's framework for the AR technology has been shared online for wider dissemination, at <https://innovationforgames.com/2022/04/14/lochee-ar/>.

TPLD-Floyen : Tipperary online:

Konglomerate Games project page for *Tipperary*:

<https://konglomerate.games/projects/tipperary-project/>

STV News report of *Tipperary* app: <https://youtu.be/-AvWWoajVL4>

InGAME Innovation Voucher cases:

<https://innovationforgames.com/ingame-projects/tpld-ar/>

https://innovationforgames.com/ingame-projects/floyen_validate/

Women in Games: Bulding a Fair Playing Field

Intervention: Evidence, analysis, and dissemination

Project team: Hailey Austin, Shiona Chillas, Ruth Falconer, Mindy Grewar

- InGAME advised cluster partner Women in Games (WIG) on its 2021 survey of games worker experiences in relation to equality, diversity and inclusion (EDI). The survey was issued to participants of WIG's international conference.
- During the conference, InGAME International staff conducted a discussion regarding women's experiences of working in the industry in China and the UK.
- With the resulting data, Women in Games published its second edition of Building a Fair Playing Field, an EDI guide for games businesses, funded and produced in collaboration with InGAME. The guide is available for free download from <https://www.womeningames.org/the-women-in-games-guide-building-a-fair-playing-field/>.
- InGAME project members are writing up further analysis of the survey data, regarding game studio approaches to diversity management, for journal publication

Women in Games (WIG) is a UK-based not-for-profit organisation founded in 2009, which works with a global community to create fairness, equality and safety for women and girls in games development and gaming.

Since the industry's founding, the percentage of workers in the global videogames industry identifying as women has not risen above 25%, despite women comprising nearly half of all workers in the general workforce and 40-45% of videogames consumers (GDC 2023, WIG 2022, Taylor 2022). Mainstream and academic media often report non-male and non-white games workers and players experiencing unequal power and pay, dysfunctional workplace cultures and abusive treatment in game-playing communities (Johnson 2018, MacDonald 2018, Martens 2021).

WIG advocates to improve these realities through its international network of industry Ambassadors, its annual conference, awards programme and other events, and by engaging with research partners. WIG has been a delivery partner in the InGAME project since its inception, supporting InGAME's first innovation lab with cluster companies in 2019, and later pursuing an InGAME innovation voucher toward development of its own membership programme.

In support of InGAME's commitment to sharing knowledge that helps cluster companies scale and add value to their organisations, it advised WIG on preparation of a survey of games worker experiences of equality, diversity and inclusion (EDI). The survey was conducted during WIG's 2021 international conference, a virtual event attracting nearly 800 attendees from 19 countries. During the conference, InGAME International staff conducted a discussion regarding women's experiences of working in the industry in China and the UK.

The InGAME project team is writing up analysis of the survey data, regarding game studio approaches to diversity management, for journal publication. Data from the questionnaire also were used to update WIG's first edition of its guide for videogames industry businesses, *Building a Fair Playing Field*. Written by WIG's Marie-Claire Isaaman and Sharon Tolaini-Sage, the second edition aims to inform and inspire organisations to incorporate ethics and leadership into their workplace management, to ensure equality for all.

A particular focus of this second edition is its Human Centred Design (HCD) approach to helping organisations establish genuine cultures of belonging for all staff. The concept emphasises making people the central focus of every step as they build greater fairness throughout their workplace management.

For Women in Games CEO Marie-Claire Isaaman, the global pandemic and ongoing societal changes were the chief drivers of this updated guide.

"The world has changed since the 2018 publication of the first Women in Games Guide. Covid-19 and its continuing aftermath have brought uncertainties, but this has also brought huge opportunities for driving positive change. Global working practices, and particularly the games industries themselves, are being transformed, and this Guide sets out to bring new impetus for gender equality and fairness."

With support from InGAME and the Interactive Software Federation of Europe, WIG has made the publication free to download, from <https://www.womeningames.org/the-women-in-games-guide-building-a-fair-playing-field/>

Women in Games online:

womeningames.org

Applied Games Lab Projects

Games technology and the future

The following projects flowed from InGAME's strategic shift toward diversifying the cluster and games sector for a more sustainable future, while benefiting society as a whole. By challenging organisations outside the sector to engage with games technology and processes as they seek solutions to wicked problems, and by broadening the application horizons of games developers, these projects use games as innovation playgrounds and drive positive change for all.

Dundee : Reimagining sustainable mobility through design, gaming and new technology

Applied Games Lab provocation:

What if the application of game design and technologies can accelerate the green transition and transform the UK's response to the climate crisis?

Intervention: Applied Games Lab: Catalyse

InGAME project team: Jen Ballie, CR&D Delivery Team

- In 2022, InGAME partnered with the University of Dundee, V&A Dundee and the Michelin Scotland Innovation Parc (MSIP) to stage a design jam event to generate solutions for sustainably transporting Dundee's people and goods
- Designers, gamers, technologists and sustainable mobility businesses contributed to the make-a-thon workshop and prototyped *Imaginarium*, a display of speculative design solutions that would provoke stakeholder responses.
- *Imaginarium* is touring Dundee community locations during 2023 to engage stakeholders

We know the future needs to be green, the question is how to get there. A desire to involve local citizens in solving how Dundee can build a green future, particularly in relation to transportation for people and goods, was the catalyst behind this collaborative R&D project steered by Jen Ballie, Reader at Duncan of Jordanstone College of Art & Design at University of Dundee, and Head of Design Research at V&A Dundee.

"Mobility is at the core of modern civilisation, and the way people and goods move around impacts many aspects of life, with around one-quarter of global CO₂ emissions coming from the transportation of people and goods. With policy pressure toward achievement of Net zero emissions rising in many countries, the evolution toward next-gen mobility is gaining further momentum."

Jen Ballie, Reader, Duncan of Jordanstone College of Art & Design, University of Dundee

In 2022, Jen worked with InGAME, the University of Dundee, V&A Dundee and the Michelin Scotland Innovation Parc (MSIP) to stage a design jam event to co-create solutions that could inform policy and decision making.

Designers, gamers, technologists and sustainable mobility businesses contributed to the workshop, which considered how gaming technology could be used to bring solutions to fruition. Among the proposed designs was the making of a digital twin for Dundee, enabling virtual problem solving, and provision of smart-city community hubs. The event also prototyped *Imaginarium*, an interactive and mobile display of speculative design solutions that would provoke stakeholder responses and co-creation of solutions.

In early 2023, *Imaginarium* and its design proposals were displayed at InGAME's showcase arcade in Dundee, and at the Michelin Scotland Innovation Park Demonstrator and Showcase, before embarking on a pop-up tour of Dundee communities.

Agri-EPI : SmARtview

Applied Games Lab provocation:

What if the application of game design and technologies could help dairy cows be healthier, happier and more productive?

Intervention: Applied Games Lab: Probe

InGAME project team: Stuart Anderson, Ruth Falconer, CR&D Delivery Team

- InGAME collaborated with Agri-EPI to deliver an Applied Games Lab about potential uses of games technology to solve needs in dairy farming.
- The lab conceived of SmARtview, an application of augmented reality (AR) technology, and applied for funds to prototype the idea.
- InGAME spent approximately £5k to stage the lab and de-risk the proposal, which successfully won £250,000 from Innovate UK—a 50 x return on investment for InGAME
- The project brought further value to Dundee studio Pocket Sized Hands, which developed and tested the prototype

Agri-EPI is one of four Innovation Centres established as part of the UK Agri-Tech Strategy. Its purpose is to drive the development, evaluation and adoption of agricultural technology to make food production more efficient and profitable, while minimising its impact on the environment. Supported by Innovate UK, Agri-EPI is committed to the delivery of research, development, demonstration and training in precision agriculture and engineering for the livestock, arable, horticulture and aquaculture sectors.

In 2019, InGAME and Agri-EPI collaborated to make improvements in dairy farming via game design and immersive technologies. An initial diagnosis of innovation needs identified demand for a tool that could provide vital data regarding the welfare and productivity of individual cows, as farmers or vets work with them in the field. Ideally, the tool would integrate such information from multiple sources and support entry of new data, eliminating the need for time-consuming office-based data processing across multiple platforms. Such a tool, it was envisioned, would apply game design principles with immersive, augmented reality technologies for data visualization, to enhance user experience.

InGAME designed an early version of its Applied Games Lab (AGL) intervention, an event fashioned to provide a playground for innovation and an incubator for commerce, where participants co-design solutions and de-risk their development toward building better futures. In this collaboration, the lab's aim was to fully understand and define the innovation challenge, ideate initial solutions, and advance the project towards securing funds for a feasibility study. Expertise in various sectors was recruited from Agri-EPI and Abertay University academics in Computing & Mathematics, and Human-Computer Interaction and Game Design, VetPartners, a veterinary services provider, and InGAME Research and Development Fellows.

Impacts

The scoping lab led the collaboration team to conceive of SmARtview, an augmented reality (AR) app that would use game technology within a HoloLens 2 headset to provide hands-free access to data, to users at the animals' sides. Machine learning would teach the tool to identify individual cows, while AR visualisation technology would enable users to see animals' health histories, integrated from multiple sources, and to enter new data, all while working in the farm environment. If the technology could lead to quicker diagnoses and interventions, it could positively impact animal welfare.

To conduct a field-based feasibility of the innovation, the scoping team applied to the Transforming Food Production Competition (part of the Industrial Strategy Challenge Fund (ISCF)) managed by UKRI. The application was a success, winning £250,000 in May 2020.

The lab benefitted the Dundee cluster by bringing opportunity for industry engagement to local studio Pocket Sized Hands (PSH). This young game company with expertise in applied games and immersive technologies was introduced by InGAME to the project team, which later commissioned PSH to undertake design and development work for SmARtview. The work and funding enabled PSH to develop its reputation and business, while helping demonstrate to the Dundee cluster the value of diversifying products and applications.

"It's really exciting to be applying technology we normally use in game development to the world of farming. We will be looking at ways to allow cow data to be easily accessed and understood."

PSH Chief Executive Gary McCartan (agri-epicentre.com 2020)

Agri-EPI is continuing to develop SmARtview. The PSH prototype was tested in a dairy farm in 2020 and returned encouraging results. Farmers and vets found the app 'game-changing', intuitively designed, quick to learn, and offering significant time savings over typical manual entry and desk-based processing of animal data.

InGAME went on to further develop its Applied Games Lab intervention, based on the early validation this collaboration provided. Given the lab and follow-up funding application work cost just £5,000 to deliver, yet succeeded in unlocking £250,000 in further funding, the project provided a 50X return on investment. The model illustrates how InGAME interventions such as the AGL enable the harnessing of videogames technology and processes to solve problems, boost productivity and drive positive change in the world beyond games.

InGAME-SmARtview online:

agri-epicentre.com

pocketsizedhands.com

Agri-EPI video about SmARtview: <https://www.youtube.com/watch?v=COZlyT2ogZQ>

<https://agri-epicentre.com/impact/smartview-cow-recognition-data-retrieval/>

<https://www.ukri.org/about-us/how-we-are-doing/research-outcomes-and-impact/ahrc/videogame-design-innovations-solving-real-world-problems/>

<https://www.abertay.ac.uk/news/2020/videogame-technology-used-to-enhance-cow-health-at-dairy-farms/>

Nesta : Virtual Healthy Neighbourhoods Challenge

Applied Games Lab provocation:

What if the application of game design and technologies can end the UK's obesity pandemic?

Intervention: Applied Games Lab: Moonshot

InGAME project team: Stuart Anderson, CR&D Delivery Team

- InGAME partnered with Nesta to co-produce a competition to harness AI, big data, digital twins, game design, and game technologies to understanding and testing solutions for healthy living and food choices.
- The project awarded 5 UK teams £5,000 each to develop and pitch concepts. From these, 2 teams were awarded £45,000 to develop proofs of concept.
- Biome Collective and Konglomerate Games showcased their playbox concepts in 2022, and Konglomerate was funded £50,000 to further develop its prototype in collaboration with Nesta
- The project demonstrated the potential value of virtual sandboxes for policy-makers, while enhancing the diversity of participating studios' development work and potential market offerings.

Supporting policymakers to play for good

Nesta is the UK's innovation agency for social good. It designs, tests and scales solutions to society's biggest problems. Its three missions are to give every child a fair start, help people live healthy lives, and create a sustainable future where the economy works for both people and the planet.

InGAME partnered with Nesta to co-produce this Applied Games Lab after identifying potential value in applying game technologies and design to understanding how food environments affect access to healthy and more affordable food options. The partnership began with a Catalyse step, launching a Challenge Call inviting games and media developers to innovate 'playboxes', or synthetic environments affording the digital twinning of real-life, complex systems such as local food suppliers, overlain with opportunities for trialling human interaction within them. For Nesta, these virtual worlds, built upon substantial data inputs and assisted by AI, appeal because they enable policy makers to better understand systemic issues and to play through potential solutions before taking action in the real world.

Advancing the AGL to Probe stage, InGAME and Nesta selected five teams from the strong field of submissions to the Challenge Call, awarding each £5,000 to advance their solutions. In the final AGL Probe phase, two of these teams, Konglomerate Games and Biome Collective, coincidentally both enterprises within the Dundee cluster, each received a further £45,000 to prove their concepts during an 8-week development phase.

"The project's gone brilliantly. We're really pleased with the two proof-of-concept games that have come out of the project, which we anticipate will be played by researchers and policy makers. Already this programme has showcased the enormous potential for social innovation waiting to be unlocked in Scotland's creative sector."

Grant Collinson, communication and engagement manager for Nesta in Scotland (Nesta 2022)

The Konglomerate Games Playbox enables users to build a city and adjust the food environment by adding or moving fast food outlets, supermarkets and restaurants, each with varying health and affordability ratings. This model enables policymakers to learn how different residents interact with elements of the food environment, and to test policies that could be enacted for the city.

Biome Collective's Playbox idea is a management simulator in which players manage resources for a virtual version of the Hilltown area of Dundee. Players make changes such as adjusting infrastructure or reformulating food products, in order to create healthier food options.

Following the solutions showcase, Nesta awarded Konglomerate a further £50,000 to prove its Playbox concept, as an early communication use case for Nesta's Healthy Life Mission Team.

"The potential of the game's development is massive. Testing on the scale the game allows would cost millions to do in a real life setting and would be extremely difficult, whereas the game lets you run infinite scenarios for free. For instance, being able to test how a sugar tax would affect a population's eating habits and therefore health over generations could be invaluable to policy makers within the government."

Jamie Bankhead, CEO of Konglomerate Games (Nesta 2022)

For InGAME and Nesta, the project enabled testing the potential of synthetic sandboxes driven by games technology to address wicked problems, in this case, building a better, more healthy future.

NESTA challenge online:

<https://www.nesta.org.uk/project-updates/exploring-virtual-food-environments/>

video summaries of Konglomerate and Biome prototypes: <https://youtu.be/BAd1lovdZLA>

<https://www.biomecollective.com/>

<https://konglomerate.games/projects/nesta-project/>

https://www.innovationforgames.com/ingame-projects/cotf_nesta/

Chapter 5

Dundee as Videogames Production Field

Introduction

Thus far, InGAME's evolution and delivery of a Creative Industries Cluster Partnership for the Dundee cluster have been the main focus of this report. Our narrative enables transferable learning about the organisation and innovation necessary to achieve economic impacts such as those of InGAME, which are expected to generate over 10 years more than 175 jobs in Scotland, with £84.7 million Gross Value Added to the economy (BiGGAR Economics 2023).

Our previous chapters have 'zoomed in' to articulate how InGAME approached increasing the cluster's scale and value, tracing its impact in two areas of practice: development of a robust model of collaborative research and development, and operation of a delivery engine designed to de-risk creative experimentation, develop organisational capacity, and stimulate innovation opportunities in the Dundee cluster. Primary outputs from among the 177 CR&D and other interventions are realised in the case studies cited throughout this report, including early iterations of the Applied Games Lab, InGAME's model for harnessing the potential of games technology and games design to solving wicked societal problems. Follow-on research to demonstrate the value of applying AGL to wider geographies and sectors will likely extend InGAME's impact.

To further appraise InGAME's influence, in this chapter, we reflect on InGAME's added value, 'zooming out' to conceptualise and discuss the contribution of InGAME at field level, to crystallise learning for videogames and other sectors. We began the report by setting out the state of play in the Dundee cluster, noting the challenges and impetus for InGAME. We now reflect on connections between practice and theory, providing a critical interpretation of how InGAME catalyses growth and diversification. The chapter looks beyond economic indicators with the help of sociologist Pierre Bourdieu's (1984, 1993, 1996) explanation of social spaces as fields. The creative industries literature often uses parallel terms for cultural production spaces, such as ecosystem, hub, or creative cluster. All these concepts, including Bourdieu's field, aim to explain the local generation of economic, cultural and social impact (Florida 2005, Panourgias et al 2013, Gutierrez-Posada et al 2022, Kitsos et al 2023). We propose that examining the Dundee cluster and its particularities as a sub-field of the global videogames production field deepens understanding of how InGAME added value to the cluster.

The chapter begins with a brief overview of the Bourdieusian tools we use in analysis, with illustrations from videogames, explaining how these concepts aid understanding of local dynamics and InGAME's interventions to disrupt status quo cultural production. With this framing, we observe the dynamic reality (DR) of Dundee's embedded position within the videogames field, and cluster agents' practice with field capitals and logics. We define InGAME as a cultural intermediary which adds value by enhancing participants' capital, shifting their logics for success and pioneering new avenues for applying videogames design and technologies to critical social, environmental, and other challenges.

Bourdieu's Concepts: Field, Capitals and Logics

Bourdieu's relational sociology explains the conditions and relations that organise fields of social endeavour. For Bourdieu (1984, 1993, 1996) a field is a social space where all agents are committed, even subconsciously, to 'struggling', or playing its game. At stake are the field's symbolic beliefs and other capital resources—what fundamentally matters in the field—and the power to legitimise these ideas. A field's boundaries, always contested, enclose individuals and organisations seeking to advance within its social structure, deploying logics for maximising its most valued forms of capitals. These elements are not static, being subject to perpetual change, as are their meanings for those who practice within and outside the field (Bourdieu and Wacquant 1992, Townley 2014).

Understanding the field thus requires seeing these elements as they relate 'in play,' at any one time (Gulledge 2011). Such vision enables identifying what is often taken for granted or misrecognised, such as preferred capitals and strategies for their accumulation and position-taking (Bourdieu 1993). In turn this framing illustrates how cultural production in the field 'works', where it needs support, or can be nudged or disrupted toward new directions. In other words, analysis of a field via Bourdieu concerns the 'strategic possibilities' of its reality, providing insight which can drive future tactics for internal and external parties (Bourdieu 1993: 176, Townley et al 2013). We use Bourdieu's theory to animate understandings of the Dundee cluster established in earlier chapters, paying attention to the multiple, dynamic dimensions organising practice, aiming to establish understandings that can potentially offer value beyond the CICP.

Another way to think of Bourdieu's field theory leans on the conventions of videogames and interactive media: his model enables a real-time, multidimensional understanding of a social space's dynamic reality. This we label DR as a nod to the industry's use of AR and VR (artificial and virtual reality) technologies. Continuing the metaphor, just as AR and VR require participants to wear headsets, we strap on a Bourdieusian headset, or theoretical lens, for the remainder of the chapter. With this, we observe the Dundee cluster as a subset of the videogames field, where participants—including InGAME--challenge its boundaries and values, accumulate capitals, and sharpen logics for achieving success.

Viewing Dundee's Dynamic Reality (DR)

As with trying any new technology, some orientation is required to enable use and understanding of DR, or Bourdieu's field theory.

Field boundaries

Our initial DR view is shaped by the borders of Dundee's cluster and its relationship with the global videogames and interactive media field. Bourdieu (1993) defines a cultural production field by its focus on the collective creation, consumption and meaning of particular cultural objects. Given these activities and understandings continually change, field boundaries are not fixed but sketched wherever relationships and interests in the primary object are contested. Further, Bourdieu identifies that some fields nest within others, a relationship reflecting the origins of power in social spaces. The field concept is thus advantageous to capturing the mercurial nature of 21st-Century, high-technology sectors. As elaborated in previous chapters, the Dundee cluster has particularities that characterise its cultural production, yet it is dominated by commercial and creative logics of the wider videogames production field. Examining relationships of the Dundee cluster, as a sub-field of the videogames field, deepens our understanding of InGAME's legacy of growing scale and value in multiple forms and spaces.

Indeed, through our DR headset we see the videogames field and other fields coming into focus and moving away as their influences on conditions in Dundee play out. In several ways, the boundaries of Dundee's CICIP adhere to its borders on paper: InGAME consists of partnerships with geographic and institutional limits, enclosing the city and its neighbouring authorities of Angus, Fife, and Perth & Kinross. Approximately 83 videogames and interactive media businesses have registered offices in this region (InGAME 2020), as do most of InGAME's industry and third-sector partners, all of whom exercise interests in game production and help shape the symbolic values in play. Aware that 'Dundee' has a meaningful reputation in the industry, many local games companies and workers praise its creative vitality, ready supply of educated labour and lower operations and living costs, all of which compare favourably to larger games hubs such as Edinburgh and London (Tag Games 2021, Bakhshi et al 2010). Such loyalty was tested by the COVID-19 pandemic, as videogames studios—digital organisations since inception yet typically preferring co-location for optimum teamwork—learned to exploit distributed working across regional and international boundaries. Yet, since the pandemic, the creative, economic and social attractions of Dundee as a physical space remain integral to many agents in its production field.

However, Bourdieu (1993) warns that pre-determined limits such as geographies do not always match the perceptions of field players, signalling key points of contestation about what matters to stakeholders. We see this in the DR of the Dundee space. For many participants, understandings of the cultural field are shaped by the nature of videogames production. The markets in which games developers engage and compete have global frontiers, even while the CICIP and its funders aim to support activity primarily within the locality. Dundee students and hobbyists who self-publish games to the major platforms find themselves exporting to, and thus needing to 'play the game' (Bourdieu 1993), of international markets. Further, there are Dundee stakeholders for whom digital working's transcendence of physical locations is attractive.

For them, the field is portable across borders and timelines, requiring only that 'Dundee' facilitates their virtual productivity and sociality, for instance with online work spaces, discussion channels, and management practices supporting distributed workforces (see Outplay hybrid working case study, page 41).

Institutional stakeholders may challenge perceptions of field boundaries, and indeed, Dundee's sub-field is impacted as external and internal notions of 'videogames' vary. Conceptually, the sector is seen by the UK government as a creative industry, because it originates 'in individual creativity, skill and talent and [has] potential for wealth and job creation through the generation and exploitation of intellectual property' (DCMS 2001). Public funding for videogames has been provided via the UK screen sector, Screen Skills, BAFTA awards and programmes, creative industries agencies such as Creative UK and Creative Scotland, and in InGAME's case, by the UK Industrial Strategy's Creative Industries Cluster Programme. However, videogames companies have argued public and private investments have been slow in coming (tiga.org), the delay perhaps partly influenced by contentions that the sector's dominant commercial orientation challenges its definition as a creative or cultural industry. Indeed, some see the videogames sector as 'far from special, rather it is an industry that like any other is concerned with manufacturing and selling commodities with the aim of generating profits' (McNeish 2013: 182, see also Champion 2013).

Thus, our DR view of the InGAME CICP reveals varying ideas of its boundaries, according to the interests of its different stakeholders. For Bourdieu (1993), these are symbolic struggles over what is important to the field, and these social challenges in turn impact the capitals and logics integral to field agents' routine practice, as we will now examine.

Capital: the currency of the field

As our DR vision moves from Dundee's boundaries to the game being played, we discern forms of capital as the currency driving the 'economy' of capitals, or resources, competencies, and beliefs perceived as essential for success in the cluster and the wider videogames field (Bourdieu 1984, 1993). Capital structures social spaces, their agents' positions determined by their differing capital stocks and legitimacy to influence field values. Agents compete to accumulate capitals and improve positions, but this requires strategic investments attuned to the rapidly changing landscape, in our case, of videogames. 'To perform effectively a player must have accumulated the appropriate capital, mastered the ability to use it effectively and understood the social, economic and cultural configurations of the capital of the field' (Townley et al 2013: 2). The field's dynamic reality thus pulses with contests and jeopardy, fuelled and constrained by the pursuit and exchange of capital.

Capital takes multiple forms depending on the field, but all fields tend to exhibit types of economic, cultural and social capitals. Additionally, Townley (2015a) has identified intellectual capital as a form vital to the creative industries.

- **Intellectual capital** is the knowledge, imagination, and skills that underlie creativity, innovation, and their transformation into valuable intellectual property (IP) (Townley et al 2019). As a product, IP is a key resource in the videogames business (see Chapter 2 for the influence of IP in business models). Intellectual capital includes the sources of creative ideas, e.g. creative workers, and their effective management, along with IP, often presents significant challenges to videogames entrepreneurs and start-ups in this innovation sector
- **Social capital** is field connections that may lead to opportunities for jobs, projects, or funding. University courses foster social capital by educating successive cohorts of industry workers. However, videogames is a notoriously secretive sector, its protection of IP often precluding collaborations beyond studio walls.
- **Cultural capital** is specific knowledge of field objects, enabling creativity and appreciation of value. As the application of games technology diversifies from entertainment to objects serving societal challenges, as described in Chapter 3, valuation of this new production requires developers and consumers conversant in a shared language of knowledge and tastes, built from field experience and cultural dispositions. This code or capital also arises from education and research in videogames, both growing in legitimacy and popularity (e.g., InGAME's DCMS evidence report, Jayemanne et al 2021).
- **Economic capital** is the assets, capacities, property, or rights that can be protected and converted to money. Its accumulation is central to videogames commercial logics, and their growing importance to local, regional and national economic strategies. Studio business models often feature complex circuits of economic capital, including revenue from hidden mechanisms within games that are otherwise free to play.

There is another type of capital circulating in all fields: symbolic capital. Accumulation of this capital manifests as power, granting legitimacy to influence what matters to the field and define who belongs (Bourdieu 1993, Townley and Gullede 2015). Symbolic capital is field-specific status, based on recognised accumulation of the other capital forms, or 'social authority acquired in previous struggles' (Bourdieu 1993: 23). In videogames, economic symbolic capital is epitomised by the industry's biggest commercial successes, some of which, produced within Dundee's fledgling cluster (e.g. *Grand Theft Auto* and *Lemmings*), have generated local-hero stature for their creators. Symbolic capital also has cultural origins, especially in field areas where creative aims dominate, and appreciation of aesthetic value rejects commercial success (the logic of art-for-art's sake) in an 'economic world reversed' (Bourdieu 1993: 8). As InGAME works to shift cluster values and logics toward games applications with vital social, but less economic, return to creators (chapters 3 and 4), the cultural-symbolic capital of industry awards, reputation, and collaborative projects becomes prestigious currency. Eventually, studios may trade on their symbolic status as their diversification efforts, advancement of capacities and ambitions within new markets lead to greater economic sustainability.

Field logics

Below we analyse the particular forms of capital visible within our DR view of InGAME's work in Dundee. But first, a further feature of Bourdieu's field sociology sharpens the view. Logic is context-specific strategy or motivation that enables a field agent to practice

cultural production effectively, a sense of how to play the field's 'game' (Bourdieu 1993, Townley 2015b). Logics can be seen as investment strategies for translating intellectual, social, and cultural capitals into economic or symbolic capital (Townley et al 2013: 2, Townley and Gullede 2015). Business models for capturing value are a form of field logic.

All creative industry fields feature a classic tension of economic values and logics opposing aesthetic-cultural aims, which participants strive to accommodate in varying ways (Bourdieu 1993, Townley et al 2009). In Dundee, studios must negotiate the cluster and wider contexts to establish appropriate logics for successfully translating capitals. As identified in preparation for InGAME's CICIP bid (Ch 2), external market conditions, particularly AAA studios, publishers and platform providers, strongly influence ideas of legitimate capital and logics within Dundee. While its many start-ups and independent developers aim to produce their own IP, such interests must be balanced with the need to survive financially, requiring engagement with the logics of videogames' political economy. Here, hardware, platforms and the games they support churn a continual upgrade culture, with attendant resource demands on producers to supply costly technical and aesthetic enhancements (Bulut 2020). Logics of videogames production are in turn legitimised by values of adjacent fields, for instance by other creative industries such as film, music and fashion, and by fields concerned with education, employment, and government. All influence the 'game plans' of Dundee's cluster studios.

What is valued? Capitals in play in the Dundee cluster

Across cultural and creative fields, Townley et al (2013) and Townley (2015a) identify four primary logics of investment in capitals, or their acquisition, maintenance, enhancement, and exchange. We now focus on these within our DR headset, analysing the capitals and logics at play in InGAME interventions in the Dundee cluster. These are summarised in *Tables 5.1-5.2, Capitals and logics in Dundee CICIP*, and described below.

		Intellectual Capital	Social Capital
Logics			
Acquisition	<ul style="list-style-type: none"> • Development of new IP content • New product/service development • Identifying creative talent <p>Projects: Agri-EPI, Hyper Luminal Games, InGAME Fellows, Lowtek, Nesta, Outplay, Reimagining Sustainable Mobility, Tag, Women in Games</p>	<ul style="list-style-type: none"> • Identifying and establishing resource and audience networks • Network building <p>Projects: Reimagining Sustainable Mobility, Scottish Games Network, Women in Games</p>	
Maintenance	<ul style="list-style-type: none"> • Managing creative teams • Protecting intellectual property rights • Managing risk and innovation <p>Projects: Lowtek, Outplay, Tag</p>	<ul style="list-style-type: none"> • Collaborative strategies • Managing stakeholder relationships • Managing dispersed production/distribution systems <p>Projects: Outplay, Reimagining Sustainable Mobility, Scottish Games Network</p>	
Enhancement	<ul style="list-style-type: none"> • Client/user/designer co-production • Skills training and development • Enhancing creative working • Knowledge customisation • Product/service diversification <p>Projects: Agri-EPI, Lowtek, Nesta, Outplay, TPLD-Floyen, Hyper Luminal Games, InGAME Fellows, Reimagining Sustainable Mobility, Tag Games</p>	<ul style="list-style-type: none"> • Network development • Inter-organisational collaboration • Exploiting digitisation for network building • Social media strategies <p>Projects: DCMS Lootbox, Reimagining Sustainable Mobility, Scottish Games Network, Women in Games</p>	
Exchange	<ul style="list-style-type: none"> • Licensing agreements • Franchise production, management and control <p>Projects: Lowtek, TPLD-Floyen</p>	<ul style="list-style-type: none"> • geographic support programmes for creativity, business • Local and regional infrastructure <p>Projects: Hyper Luminal Games, Nesta, Scottish Games Network, Tag, Biome, Konglomerate</p>	

Table 5.1. Capitals and logics in Dundee CICP (adapted from Townley et al 2013, Townley 2015a)

Cultural Capital		Economic Capital
Logics		
Acquisition	<ul style="list-style-type: none"> • Cultural access • Identification of unique products/ services • client/audience/market intelligence and analysis <p>Projects: DCMS Lootbox, Hyper Luminal Games, TPLD-Floyen, Reimagining Sustainable Mobility</p>	<ul style="list-style-type: none"> • Accessing organisational and financial support • Acquiring skills for start-up and business planning • SME policy infrastructure <p>Projects: DCMS Lootbox, Hyper Luminal Games, Lowtek, Outplay, Tag</p>
Maintenance	<ul style="list-style-type: none"> • outreach, education programmes • Client/audience/market analysis • Positioning and placement • New market development <p>Projects: Agri-EPI, DCMS Lootbox, Lowtek, Nesta, Scottish Games Network, TPLD-Floyen, Reimagining Sustainable Mobility, Women in Games</p>	<ul style="list-style-type: none"> • Business support services • sustainable business • Risk analysis • Securing cash flow <p>Projects: Lowtek, Outplay, Tag, TPLD-Floyen</p>
Enhancement	<ul style="list-style-type: none"> • Enhancing consumer access • Engaging cultural intermediaries • Developing brands • Identifying new audiences <p>Projects: Lowtek, TPLD-Floyen, Scottish Games Network, Waterfront Park, Women in Games</p>	<ul style="list-style-type: none"> • Identifying new business opportunities • Accessing venture capital • Growth strategies, mergers, acquisitions <p>Projects: Hyper Luminal Games, Lowtek, Outplay, Scottish Games Network, Tag, TPLD-Floyen</p>
Exchange	<ul style="list-style-type: none"> • Leveraging evaluation and impact metrics and assessments • developing alternative income streams <p>Projects: Lowtek, Reimagining Sustainable Mobility, Scottish Games Network, TPLD-Floyen</p>	<ul style="list-style-type: none"> • Divestment strategies

While nearly all the InGAME projects described in previous chapters have interests in all four forms of capital, in *Table 5.1* we identify projects illustrating particular forms and logics, their interplay reflecting the idiosyncrasies of the wider videogames sector.

For example, intellectual capital in various sources was the key focus of projects with Lowtek, Outplay, and Women in Games (WIG). Lowtek's genesis of an innovation, a technological aide for dyslexic game players, and its transformation with InGAME assistance into an IP ready for commercialisation, illustrates classic creative industries production with logics of capital acquisition, maintenance, enhancement, and exchange (Townley 2015a, Townley et al 2019). The Lowtek case also concerned cultivation of its innovator into a company owner, a transformation of the human form of intellectual capital enhanced by acquisition of economic and symbolic capital. Both Outplay's aim to adapt its management to post-pandemic challenges, and WIG's focus on improving fairness for all games workers, concern coordination of staff and support for their welfare, or the maintenance and enhancement of staff as intellectual capital. Both projects also generated original intellectual capital in the shape of research and management guidance.

Scottish Games Network (SGN) works to build the potential strength in social capital of Scotland's videogames development community. Its voucher project with InGAME identified issues of capital acquisition, maintenance, enhancement, and exchange faced by game companies across the country and proposed solutions for filling the network's gaps. By aiming to help the national industry infrastructure grow in strength, diversity and value, SGN fosters exchange of the collective's social capital for other capital forms.

Cultural capital was a primary tool deployed in InGAME's Loot Box Rapid Evidence Assessment for DCMS, and in the Reimagining Sustainable Mobility project. In both, InGAME coordinated experts in videogames and interactive technologies to evaluate current knowledge and identify optimum uses. By communicating their assessments and suggestions—via the DCMS evidence report (Jayemanne et al 2021) and the mobility project's *Imaginarium*—the projects enhance other stakeholders' cultural capital, potentially improving their engagements with the technology.

Economic capital and strategies for profiting are illustrated by InGAME's interventions with Tag Games and Hyper Luminal Games. Tag's placement on the Creative UK Games Scale Up programme addressed its need to acquire and maintain additional business skills, including development of company structure. Along with enhanced social capital it attained through exposure to the programme's network, these capitals helped grow its staff and land a publisher investment, providing a significant economic enhancement to support its online game development. Hyper Luminal engaged with InGAME having already prioritised development of games that have positive, enriching impacts for players and the world. It invested in this logic through the Inclusive Design for Immersive Experiences Challenge, in which the studio acquired new economic opportunities as well as intellectual capital as it learned to integrate inclusivity and accessibility in games development. A substantial cash award plus skills, business and investor support from InGAME and Open Inclusion enabled Hyper Luminal to develop IP in the form of its game *Pine Hearts*, and internal guidelines for communication, design and testing processes which will ensure its future products align with its business logic.

Adopting the DR vision, Bourdieu's theory enables an understanding of fields as competitive game spaces, where participants' capitals, positions, and logics for investment interrelate within live, strategic play (Bourdieu 1993, Gullledge 2011).

Intellectual capital is a key success factor that redefines creativity for the context of videogames. Development and conservation of Intellectual Property rights and the associated licensing and protection, curation and management of creative teams and new product development are elements of intellectual capital displayed in the case studies. Cultural capital, which in creative contexts is often passed down through the family or acquired via education is inscribed in the development of videogames as a separate sub-field and legitimate creative industry. Legitimation is underway in terms of developing the appreciation of a game as a cultural artefact – in the language of games, the technical expertise and power to develop new markets and audiences for games, and the 'insider gaze' that permits statements of value and critical appraisal (Bourdieu 1997). Social capital implies membership of a community and leverage. Here we can point to the social capital acquired and enhanced through the agency of InGAME and the CR&D project.

A feature common to each of the above cases is the vital circulation in the field of symbolic capital, energised by InGAME's performance of a particular kind of role within Bourdieu's (1993) model of cultural production fields, the cultural intermediary. In the next section, our DR focuses on InGAME as intermediary in the Dundee cluster.

Adding Value as a Cultural Intermediary

Cultural intermediaries negotiate and influence fields' economies of beliefs and values and thus play a central position in the game of cultural production (Bourdieu 1984, 1993). Cultural intermediaries structure meaning in spaces between the field's non-commercial, aesthetically oriented logics, and its material, market-facing interests. They influence symbolic capital, the ideas that matter within the field, introducing change as they patrol the boundaries of its culture, promoting newly legitimate objects and ideas and rejecting those that fall from fashion (Bourdieu 1984). Further, they enhance other agents' capital and influence practice as they forge connections, frame and communicate ideas, and model tastes for consumption.

InGAME conducts this intermediation through its operations engine, designed in response to readings of cluster conditions and potentialities, capitals and logics. InGAME positions itself to act, in its own language, as an 'innovation broker' and as 'a convenient force-- somebody there to help. That's partnership development, that's horizon-scanning, that's a neutral process that is there to drive innovation' (Sean Taylor).

In each of its three work themes (page 20), InGAME can be seen intermediating. To de-risk creative experimentation (theme 1), InGAME identifies capacity and constraints in SMEs, providing resources directly through labs or workshops, or by using social capital to provide training and network building through partners such as Creative England and V&A Dundee Design for Business. By exposing companies to design challenges, investment opportunities, and markets, InGAME activities motivate them to develop higher-value products, services and processes, compete for commissions or contracts, and improve their field positions. In the scale-up, or commercialisation, work theme (#2), InGAME works to influence SME values by demonstrating the material and symbolic worth of engaging in speculative work and by encouraging development of intellectual capital into commercial forms.

InGAME actions identify how and where to exchange accumulated capitals in new fields and markets, introducing field participants to potential investors and promoting collaborations. For the diversification work theme (#3), InGAME has aimed to challenge how cluster members can break through boundaries that may restrict innovation and sustainability, by stimulating them to apply intellectual and cultural capitals to solve problems in other fields. As illustrated by the Applied Games Lab projects with Nesta and Agri-EPI, such activity redefines logics, stimulates innovation, and forges productive collaborations, in turn re-defining the purpose of games.

To translate and influence cultural values of a field, intermediaries must have recognised cultural capital and symbolic status. For InGAME, this comes from the substantial knowledge and field-level recognition contributed by the CIGP steering, management and delivery teams. Representatives of videogames companies, financial and industrial development agencies, and higher-education institutions shape the work of InGAME's delivery team, who are employed by the cluster's universities. InGAME's director, researchers, and project coordinators contribute intellectual and cultural capital in games development and technology, design, organisation and research. Together, they are lent additional symbolic capital by significant backing from government, via UKRI and the Scottish Funding Council, by industry bodies such as Ukie, TIGA, Scottish Games Network, and Women in Games, and by regional institutions such as Dundee City Council, Scottish Enterprise and Creative Scotland. InGAME also has pursued international collaboration, and conducted an allied 3-year project with China, funded by AHRC:

See https://www.innovationforgames.com/ingame_international.

InGAME has invested these substantial capitals and reaped symbolic rewards in terms of industry recognition for SMEs that worked with it (Lowtek's Scottish Games Award 2022 for Best Tools and Technology (*Dislectek*)), and for itself, such as TIGA UK Games Education Awards 2021: Excellence in Games Research, national commendations (Scottish Funding Council 2022, *Playing to Win: Our Scottish Future*, 2022), and a UK-government commission (DCMS Loot Box Rapid Evidence Assessment, 2021). End-of-project evaluation reports, research dissemination and showcases for local, national, and international audiences further invest InGAME's capital as the project members work to secure sustainability.

Cultural intermediaries add a layer of dynamism to social spaces, assisting and amplifying the production of cultural values and agents' competition for field stakes. In Dundee, InGAME was instituted to disrupt the symbolic values and resources driving cluster videogames production during preceding decades. Acting as a catalyst for innovation, InGAME was able to develop a network beyond the confines of Dundee and leverage connections to secure material and symbolic profits.

"I think we have helped challenge ... but also presented new opportunities and new frontiers to [help games companies] move beyond their comfortable playbooks, and try and push them on. Not everyone has taken that and not everyone's up for that and that's fine, but the few people that have stepped through that door are certainly thinking and acting differently in their approach."

Sean Taylor, InGAME Director

Conclusion: Legacy and Insights

InGAME's success in the Dundee cluster has been significant (see 'Economic Impact of InGAME', innovationforgames.com), yet value is not only economic. Our analyses have drawn a picture of the Dundee videogames cluster and its activities which differs to understandings provided by other evaluative means. We parse InGAME's approach to catalysing scale and value using Bourdieu's field framework as a scaffold on which to build appreciation of this social space and its dynamic reality. We demonstrate how InGAME added value through analysis of the field's cultural, intellectual and social capitals, their investments through logics and the symbolic work of InGAME as cultural intermediary. This analysis aides understandings of how InGAME's enduring dimensions organise typical practice, illuminating the resources and roles that could be introduced to stimulate cultural production in other contexts. The legacy of InGAME lies in its capacity to transform through collaborative R&D in a working model of practice that offers insights beyond the funded period.

Among these transferable insights, we note the following:

1. **Apprehending the practice field:** Initiated in the planning stages for InGAME and continued throughout its delivery, assessment of the typical forms of capital valued by cluster studios, and their logics (e.g. business plans) for pursuing and exchanging them, informed InGAME's own strategy for applying resources to activate cluster growth—practice we now understand as cultural intermediation. Understanding the range of capitals in play focussed cluster partners to look beyond purely economic capital accumulation and market exchange, to more foundational issues such as studios' business and technological capacities, and aspirations toward diversification. InGAME's most recent field focus, on the expanding horizons of videogames applications, challenges beliefs about the very nature, purpose and worth of the field, particularly in relation to societal issues.
2. **Field intermediation:** Our analysis identifies the role of innovation broker, or cultural intermediary, which could be introduced to stimulate cultural production in other contexts. The legacy of InGAME lies in its practice model for adding value through collaborative R&D, activating participants' resources for profiting symbolically and materially. Its sense-and-respond operations engine, its Applied Games Labs for catalysing solutions-focussed IP, and its theory of change and exploration of applications to other fields, have generated significant achievements which will continue to pay dividends to the cluster. Meanwhile InGAME's own symbolic capital, particularly its recognition as a productive intermediary of the videogames field, has grown as the programme has progressed, leaving it in ideal position for extending its work within and beyond the cluster.

3. **Defining and challenging boundaries:** Consideration of the cluster's boundaries and their varying interpretations raises questions about the degree to which material and geographic borders, and producers' co-location within them, are desirable for research and development in the creative industries. As workers and organisations continue to learn to operate in more distributed ways, supported by technology and conceptions of new realities such as the metaverse, perhaps clusters will be better defined by their goals or capabilities. For governments and industries seeking to support and capitalise on hubs of activity defined by physical location, such framings may require redrawing, particularly when the cultural production within them, such as videogames and interactive media development, thrive on disrupting the status quo. Indeed, it is through continuous monitoring of field horizons and enabling studios to reach beyond them, that InGAME has activated its theory of change regarding impactful videogames development of the future.

Our analyses identify that the accumulation of economic capital in this emergent creative industry is precarious. Access to support required to create and sustain micro-sized businesses in videogames echoes a familiar tension in the field of cultural production (Bourdieu 1993). The creative endeavours of games producers relies on the infrastructure of creative industries policy, venture capitalists and the symbolic capital or legitimacy of a sector that has a short history. Despite the importance of the creative industries to the national economy, and the particular potential of growth in the combination of technology with creativity, investment remains patchy (House of Lords 2023). The connection of videogames with entertainment, its reliance on mass production and competition within the creative economy, dilute its capacity to attract investment.

Such insights about the Dundee field are available to policymakers, funders, and others who would apply Bourdieu's theory to study the dynamic reality of any industrial field. Thinking about clusters as cultural production fields, where agents and their practices are subject to but also invigorated by forces related to certain capitals and logics for 'capitalising' with them, illuminates where fields face challenges or can be disrupted in new directions. More specifically, understandings from such analyses can inform resource planning, goal setting and reporting, especially in terms of achievements that capture more than economic returns on investment. This in turn helps policy and funding bodies to understand the broad range of factors integral to cultural production, including the enhancement and acceleration provided by cultural intermediaries such as InGAME.

Appendix

Selected InGAME Publications

Commissioned Evidence Assessment

Jayemanne, D., Chillias, S., Moir, J., Rocha, A., Fraser, S. & Wardle, H. 2021. Loot Boxes and Digital Gaming: A Rapid Evidence Assessment. London, Department for Culture, Media and Sport. Available: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1091282/InGAME_Loot_Box_REA.pdf. Accessed 11-07-2023.

Academic papers

Anderson, S. (in development). 'Automated Testing-Player Modelling/Classification'.

Cowling, M., Brown, R., & Rocha, A. (2020). 'Did you save some cash for a rainy COVID-19 day? The crisis and SMEs'. *International Small Business Journal* 38(7), 593–604.

Brown, R., and Rocha, A. (2020). 'Entrepreneurial uncertainty during the Covid-19 crisis: Mapping the temporal dynamics of entrepreneurial finance'. *Journal of Business Venturing Insight* 14.

Clark, L. (2021). 'Towards Creativity Amplification: Or AI for Writers, or Beating the System.' *Writing in Practice* 7: 134-145.

Clark, L., and Sood, D. (2022). 'Working Backwards: Creating a Character Backstory Generation System Using Idealized Creative Writing Outputs.' In *Proceedings of the 17th International Conference on the Foundations of Digital Games*, Association for Computing Machinery, New York. Article 29, 1–9.

Clark, L., Jung, J.-I., Anderson, S., Blackham, P., and Sood, D. (2020). '*Euphonia*: Reflecting on the Design of an AI-Powered Voice-Controlled Narrative Game.' In *Extended Abstracts of the 2020 Annual Symposium on Computer-Human Interaction in Play*. Association for Computing Machinery, New York, 204–208.

Grewar, M., Chillias, S., and Falconer, R. (in development). 'Shiny emails and candles: Missteps in managing diversity in videogames studios'.

Jung, J.-I. and Blackham, P. (2020). 'Hot Summer Afternoon: Towards the Embodiment of Musical Expression in Virtual Reality'. In *xCoAx 2020, Proceedings of the eighth conference on computation, communication, aesthetics & x*, 398-400.

Lacey, G., and Falconer, R. (2020). 'Evaluating clustering methods underpinning content generation in games using GANs.' In *GAME-ON 2020: Proceedings of the 21st International conference on Intelligent Games and Simulation*, 26-31.

Sloan, R. and Saurin, A. (2019). 'The enemy within: designing a cell-based gameplay system for cancer education.' In Extended Abstracts of the Annual Symposium on Computer-Human Interaction in Play (CHI PLAY '19 Extended Abstracts). Association for Computing Machinery, New York, , 117–123.

Ross Brown, Suzanne Mawson & Augusto Rocha (2022). 'Places are not like people: the perils of anthropomorphism within entrepreneurial ecosystems research'. *Regional Studies* 57:2, 384-396.

You, X. (2022). 'Applying design thinking for business model innovation'. *Journal of Innovation and Entrepreneurship* 11: 59.

Blog

Sood, D., (2022). 'Walk The Streets Of 1941 Lochee, Dundee: A Framework For Large-Scale Outdoors Augmented Reality Game Design.' *GameDeveloper.com*, March 18, 2022, Available: <https://www.gamedeveloper.com/blogs/walk-the-streets-of-1941-lochee-dundee-a-framework-for-large-scale-outdoors-augmented-reality-game-design>. Accessed 11-07-2023.

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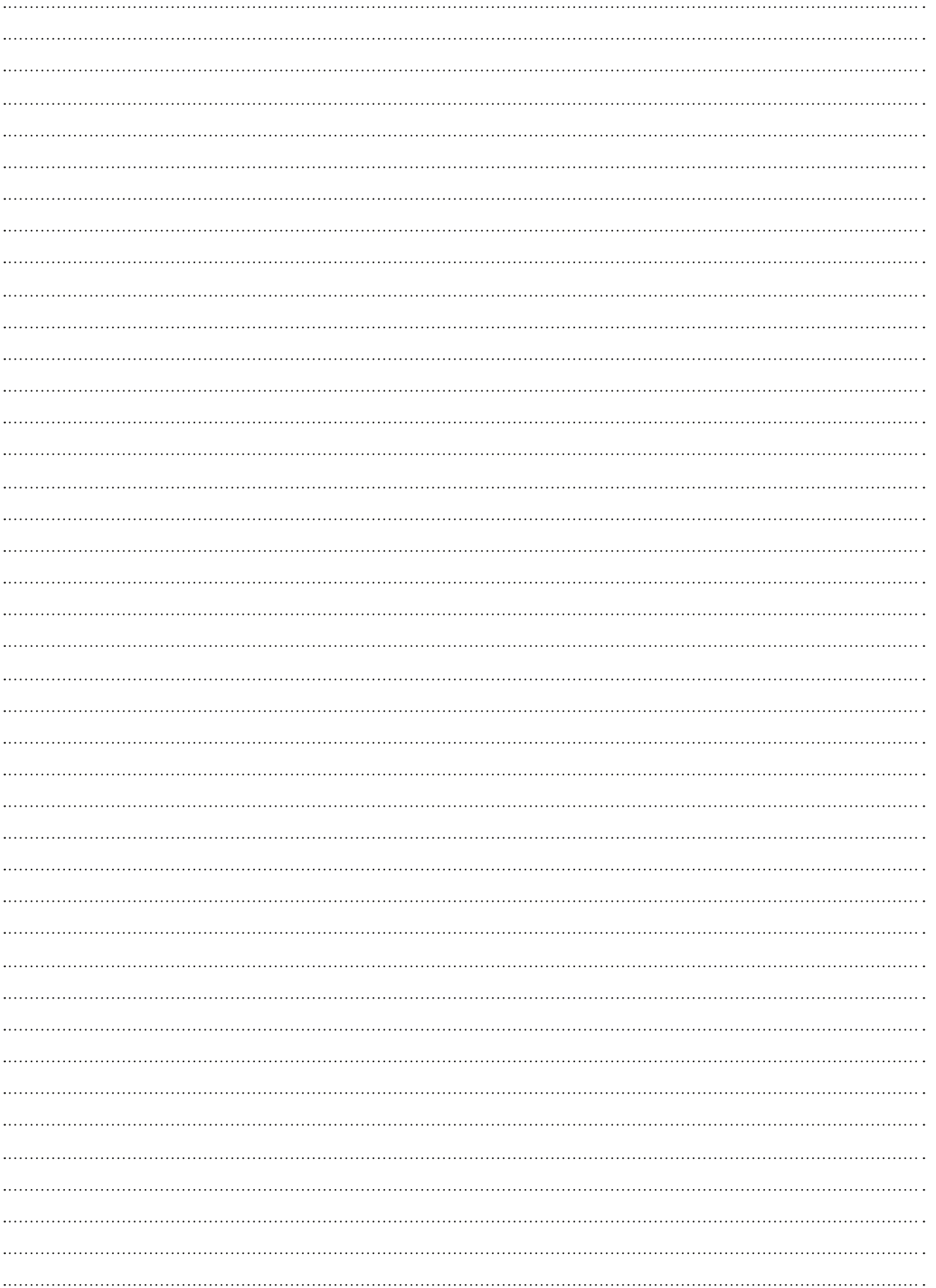
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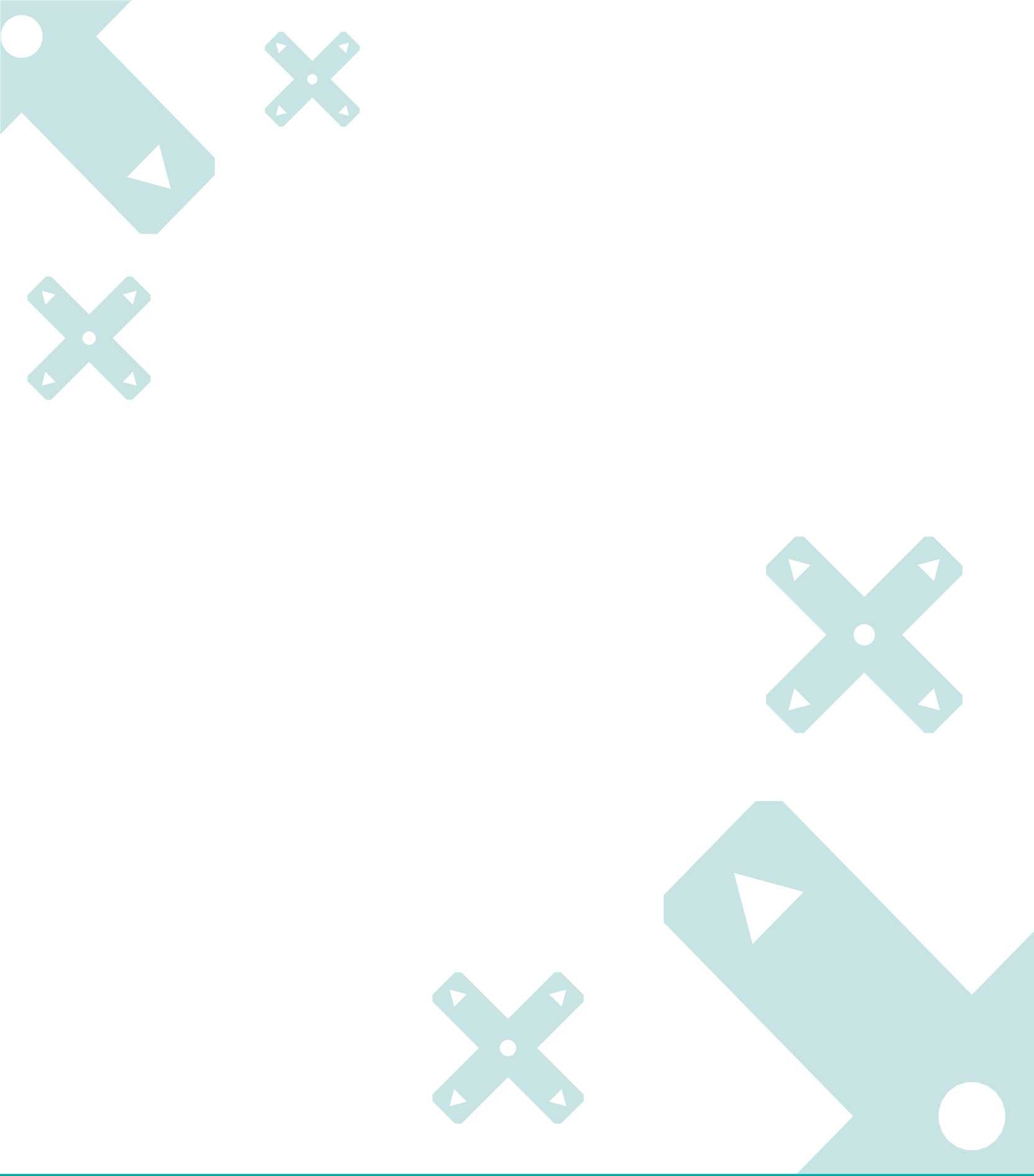
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Notes

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Creative Industries  Clusters Programme

 Arts and Humanities Research Council

 Scottish Funding Council
Promoting further and higher education