

4 Supporting R,D&I in the creative industries

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Studying optimal levels and timing of R,D&I support

Gauging the right levels of support for R&D is a key part of cultivating an innovative environment in the creative industries, enabling innovative ecosystems to work as effectively as possible. The lack of understanding of R&D processes in the creative industries means there is little research about the optimal levels of R&D support (see also Chapters 1 and 2). The creative industries is a diverse sector consisting of project-based small enterprises, each with its unique demands and challenges (Flew & Cunningham, 2013). In previous chapters, we have described how, to address a range of different requirements, R&D support needs to be diverse and adaptable. Funding organisations can promote a more vibrant and varied innovation ecosystem by providing financial support for a wide range of creative projects (O'Connor & Gibson, 2015). Moreover, as we described in Chapter 1, the effectiveness of R&D support in the creative industries is heavily influenced by the available support, which often includes not only financial support but also opportunities to connect with networks, expertise, and spaces for collaboration (McRobbie, 2018).

In this chapter, we draw upon our analysis of R,D&I projects supported by the Clwstwr programme to address a very practical question: what are the optimal levels and timing of support for R,D&I projects? Our study examined 68 creative projects funded by Clwstwr. Data has been collected from project participants about their innovation journeys through thorough ex-post evaluations and interviews (see Chapter 1 for more information and details about the methodology). Our longitudinal method – asking projects to trace the success reached at various levels of their R&D journey in continuous time – acknowledges the dynamic nature of creative R,D&I and allows a better understanding of the intricate connection between support interactions and project satisfaction.

The findings highlight the importance of implementing a prompt and comprehensive support approach that is tailored to the specific needs of the creative industries. Funding schemes can enhance project satisfaction

and innovation outcomes by incentivising early milestones and maintaining moderate support engagement. The broader benefits of R&D assistance, such as increased resilience, innovation capacity, and socioeconomic spillover effects, underscore the significance of public investment for creative industries' R,D&I. We begin with a literature review about the current state-of-the-art in research on the effectiveness of public funding for R&D and the theoretical foundations of our analysis. The findings present a visualisation of the R&D journeys of creative industries' projects and the optimal support levels and timing.

Research on the effectiveness of public funding

The importance of public funding in promoting innovation has been widely recognised, particularly in industries where private investment is limited due to significant risks and uncertain profitability. Public funding can be obtained for innovation through various means, including grants, subsidies, tax incentives, incubator programmes, and collaborations between the public and private sectors. The effectiveness of these funding mechanisms is often contingent upon the way they are designed and implemented. Specifically, public funding has greatly benefited high-risk, high-reward ideas that may not attract private investment otherwise. An example of this is the Small Business Innovation Research (SBIR) programme in the US, which has granted funding to several emerging businesses that later become dominant players in the market, such as Qualcomm and Symantec (Wessner, 2008).

Addressing the 'valley of death' – the gap between the initial stages of development and market readiness – is a critical challenge in the field of innovation. Public funding has effectively addressed this gap by providing resources during the initial stages when private investment is restricted. Efforts like the European Union's Horizon 2020 have played a crucial role in assisting projects in overcoming this challenging phase, for example (Mazzucato, 2011). Public funding has facilitated the formation of alliances between the government, business, and academia, fostering collaborative innovation. According to Breznitz and Ornston (2013), these collaborations have played a vital role in promoting various sectors, such as biotechnology and renewable energy.

Despite these accomplishments, there are still several areas where the allocation of public funds for innovation has encountered challenges. In instances of bureaucratic inefficiency, partiality, and lack of transparency, funds may be assigned to projects that are deemed less deserving. This misallocation also diminishes the overall effectiveness of funding initiatives (Lerner, 2009). Another significant challenge is to ensure the ongoing viability of funded projects. Although public funding and support can stimulate innovation, sustained support or supplementary funding, which is not always guaranteed, is often necessary to ensure the long-term

viability of these projects. Projects may experience a halt in progress once the initial funding period ends if they rely on public funding and lack a clear path to financial self-sufficiency (Azoulay et al., 2019). The effectiveness of public funding is also greatly affected by timing and organisation. Milestone-based funding, as described in the literature, can enhance accountability and focus by ensuring that payments are only disbursed upon the successful completion of specific project milestones. However, the task of selecting the appropriate benchmarks and schedule for these assessments remains challenging (Chen et al., 2020).

In terms of funding levels, inadequate support can lead to the failure of a project, while an excessive number of interventions (even if guided by the best intentions) can reduce the drive for creativity and effectiveness. So, for example, Gök and Edler (2012) advocate a balanced approach, which entails providing sufficient funding to meet project requirements without being overly generous and promoting wastefulness. In general, however, there is a lack of agreement on the optimal level of support for different types of projects, the most effective approach to organising funding to achieve maximum impact, and the appropriate timing for milestone reporting and achievements. These gaps indicate the need for evidence-based guidelines that can inform practices and policies regarding public funding. The theoretical foundation to analyse the optimal level and timing of funding for R,D&I includes various key concepts derived from organisational behaviour, economics, and innovation theory.

First, public funding has been – and remains – a key driver of innovation. From a macroeconomic standpoint, this is explained by public goods and market failure. The purpose of public funding is to address the market failure resulting from insufficient investment in R&D, especially in the creative industries. In these industries, the benefits of innovation are often non-rival and non-exclusive and difficult to achieve through private means (Arrow, 1972). Public funding is expected to generate significant positive externalities, such as knowledge spillovers and a more dynamic innovation ecosystem.

Second, resource-based theory posits that supporting resources play a crucial role in fostering innovation, particularly for small and medium-sized enterprises (SMEs) that often face constraints in funding (Barney, 1991). The provision of support can significantly enhance these businesses' ability to undertake and accomplish projects. However, there may be a point at which additional support does not yield proportional benefits, indicating diminishing returns. Similar observations also emerge from the absorptive capacity theory literature, which suggests that successful innovation is contingent upon an organisation's ability to recognise, assimilate, and utilise new knowledge (Cohen & Levinthal, 1990).

Third, organisational learning theory posits that achieving successful outcomes necessitates continuous learning and adaptation (Argyris & Schön, 1997). It is possible to attain an optimal level of engagement with

funding programmes that will promote iterative learning and adaptation without hindering individuality or creativity. This supports the idea that projects that incorporate learning cycles and iterative feedback tend to achieve greater innovation outcomes and higher levels of satisfaction than projects that have either too much or too little external intervention.

Fourth, the stakeholder theory, proposed by Freeman (2010), highlights the importance of effectively managing relationships with all stakeholders in order to achieve organisational objectives. This suggests that interactions with funding organisations should be well-managed and should Align with expectations and interests of all parties involved. The hypothesis suggests that aligning the assistance received with the project will enhance project success and satisfaction, as it will be perceived as advantageous and collaborative.

Finally, according to the theory of planned behaviour (Ajzen, 1991), the expectations and satisfaction of participants play a crucial role in determining project outcomes. This theory highlights the influence of attitudes, subjective norms, and perceived behavioural control on shaping intentions and behaviours. So, for example, early project milestones will have a positive impact on participants' perceptions of control and progress. This, in turn, is expected to lead to increased overall satisfaction and project success. Conversely, decreased satisfaction can occur when milestones are achieved prematurely without adequate preparation, as this may be perceived as superficial advancement. The technology acceptance model (TAM) and innovation diffusion theory (Rogers, 2003; Davis, 1989) also suggest that the timing of milestones is crucial, albeit in different ways, as early achievements will validate the perceived usefulness and usability of the innovation, leading to greater acceptance and satisfaction.

Our theoretical framework therefore generates three testable hypotheses:

- 1 Optimising interaction with support teams can maximise project outcomes;
- 2 Achieving early milestones will enhance satisfaction and perceived control; and
- 3 Premature milestones and the associated expectations have a detrimental effect on the R&D process.

Understanding optimal support for R,D&I

Identifying the typical R&D journey in the creative industries

The data for this study were derived from two main datasets provided by 68 Clwstwr-funded projects. Both were collected ex-post, at the end of

each project's life span (although many projects continued to develop after that point). During the data collection phase, representatives of projects were asked to trace their R,D&I journey visually, while also providing commentary at key moments in the timeline, including their project milestones. The project's lifespan has been split into four quarters, the length of which may be different from one project to the other: projects varied considerably in timelines, though most were between 3 to 12 months, while some received 2 rounds of support (seed funding and development funding – see Chapter 1). The project teams were also asked to characterise their expectations about their innovative processes before its start, as well as at its end. Scores, ranging from -2 to 2 , were allocated to these distinct points in time, depending on the projects' characterisations of their expectations. Initial expectations reflect a baseline level of optimism for the R&D projects, while all other 'satisfaction' ratings (also ranging from -2 to $+2$) reflect how well these initial expectations had been met.

The visual ratings provided by the 68 projects for each project stage, when superimposed on one another, allowed us to visualise the 'typical' R&D journey in the creative industries (Figure 4.1). This is the 'typical' path in the sense that it provides the average score reflecting how well expectations have been met across all R,D&I projects. The summary statistics (with the corresponding standard errors) show relatively little spread (Table 4.1). A typical journey starts with high expectations, experiences a dip along the way but concludes on a high note, ultimately exceeding initial expectations.

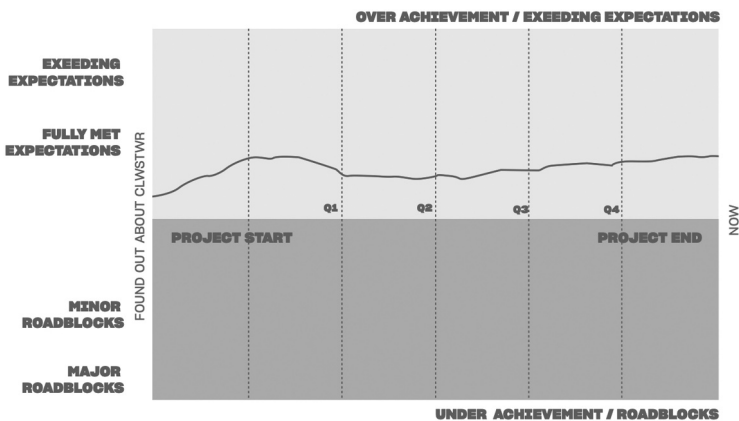


Figure 4.1 The typical R&D journey in the creative industries.

Table 4.1 Summary statistics of R&D journey in terms of expectations and how closely they have been met, on a scale from -2 to +2.

<i>Time point</i>	<i>Mean score</i>	<i>Standard error</i>
Initial expectations	0.3206	0.0243
End of pre-contract phase	0.7485	0.0302
End of Q1	0.5191	0.0211
End of Q2	0.5250	0.0234
End of Q3	0.5797	0.0229
End of Q4 (project end)	0.7059	0.0312
End of after-project period	0.7731	0.0337

The experience of the *Lewnah* project – which aimed to develop an engaging news programme for younger children – exemplifies a typical innovation journey and is useful to quote at length.

So we signed the contract around September. We had no expectations really at all, having never undertaken R&D before, and doing a project that was out of our comfort zone. The project's about news which is our area, but we were using animation and technology that we were completely unfamiliar with. So I would say that we were thrilled, obviously, to get the initial bit of funding, which was seed funding, so we were kind of like up here. We didn't even really know where to start. The support that we got from Clwstwr was fantastic in terms of PDR workshops. They were incredibly helpful in giving us the initial tools of how to ask the right questions and get the right answers from the right demographics of people. I would say that from the off it kind of exceeded our expectations in terms of how much work there was to do and how possible and feasible it was because we were conducting this R&D alongside our day jobs as well. So, having exceeded expectations initially, I would say we probably continued to do that, and they were very supportive when we had some dips just in terms of our time. The only reason I put a slight dip in there was just because it was more time consuming than expected. I didn't have enough time to commit at various stages.

As well as satisfaction and expectation scores, milestones achieved have been documented and categorised. Milestones were aggregated by project and summarised by quarter, both before and after the project's end. The main milestones recorded are the following: (a) Commercial Readiness, (b) Hiring New Employees, (c) Increasing Turnover, (d) Increasing Exports, (e) Generating Revenue, (f) Developing R&D Strategy, (g) Spending Time on R&D, (h) Obtaining Intellectual Property (IP), (i) Societal Impact, (j) Environmental Impact, and (k) Partnerships. The milestones align with quantifiable measures in the KPI list used in the first part of the interview (see the methodology section in Chapter 1 for more details).

Table 4.2 The number of milestones reached at each stage of the innovation project on average across all projects participating in the research.

<i>Period</i>	<i>Mean milestones</i>	<i>Standard error</i>
Before project start	1.25	0.15
Quarter 1	2.75	0.21
Quarter 2	3.10	0.22
Quarter 3	2.60	0.20
Quarter 4	2.90	0.23
After project end	1.50	0.18

The summary statistics show how many of the above milestones have been reached across all projects on average (please note that there is no hierarchical ranking of milestones and each counts as ‘one unit’ in Table 4.2). The data suggests that milestone achievements peak in the 2nd and 4th quarters. Reading against the expectations timeline we can see that Quarter 3 comes at a time following a dip in expectations when projects were refining or refocusing their R&D projects. Post-project milestone achievement is lower, indicating that most significant milestones are planned and achieved within the project’s active phase.

The optimal amount of support for R,D&I projects in the creative industries

We also collected data on how many times each individual project received support through the Clwstwr ecosystem. This included (a) interaction with support staff, (b) participation in training and workshops, and (c) participation in events (see Chapter 1 for more details). According to this definition, the average project has – during its lifespan within the programme – received support 4.28 times, with a standard error of 0.54. In line with the theoretical framework laid out in this chapter, two main hypotheses were examined with rudimentary econometric techniques. First, we examined the effect of the number of support sessions on the satisfaction scores at the end of the project (Quarter 4). The theoretical framework suggests that this relationship may be non-monotonic. To test if this is indeed the case, we ran the regression analysis (Equation 4.1).

Equation 4.1

Ordinary Least Squares regression to examine the optimal amount of support given to projects.

$$Y_i = a + b_1X_i + b_2X_i^2 + e_i$$

where Y_i is the project-specific satisfaction score about reaching expectations (between -2 and +2) at the project's end (Quarter 4), a is the constant term, b_1 and b_2 are regression coefficients reported in Table 4.3, X_i is the number of times that each project has interacted with Clwstwr and e_i is the project-specific prediction error. The theoretical framework, suggesting that there may be a 'sweet spot' for levels of support, would be confirmed if b_1 was statistically significantly positive and b_2 statistically significantly negative. If so, there would be empirical evidence that maximum satisfaction is reached at an intermediary level of support, while more extreme levels (either low or high) of support provide lesser satisfaction with the R&D journey.

The second hypothesis concerns the timing of milestones and satisfaction levels at the end of the project (as well as after the end), testing the theory that projects that hit milestones early generally report higher levels of satisfaction towards their end, but hitting them too early may be detrimental to long-term success. These hypotheses are evaluated using simple ordinary least squares regressions without quadratic terms as noted in Equation 4.2.

Equation 4.2

Ordinary Least Squares regression to examine the optimal timing of milestones.

$$Y_i = a + b_n X_{in} + e_i$$

where a is the constant term, b represents the regression coefficients, n is a number between 1 and 6, with 1 denoting the period before the projects signing the funding contracts and 6 the period after the end of the project. X_{in} shows the number of milestones reached by each project at stage n . e_i is the project-specific prediction error.

The first hypothesis on the optimality in the number of support interventions holds empirically (Figure 4.2). Average levels of satisfaction clearly increase in line with the number of interactions with the support to a 'sweet spot' of an optimal intervention rate, after which it decreases. This pattern is also documented in the regression output from running the regression in Equation 4.2 (Table 4.3).

The regression coefficients are as expected and very close to statistical significance. Since the sample is very small, the economic significance of the results is amplified. (It is very difficult to reach statistical significance at the 1, 5, or even 10% level with such small datasets, especially in the case of a non-monotonic regression.) Nonetheless, the evidence shown in Figure 4.2 is compelling enough to suggest that there may indeed be a 'sweet spot' in the number of interactions/interventions in R,D&I

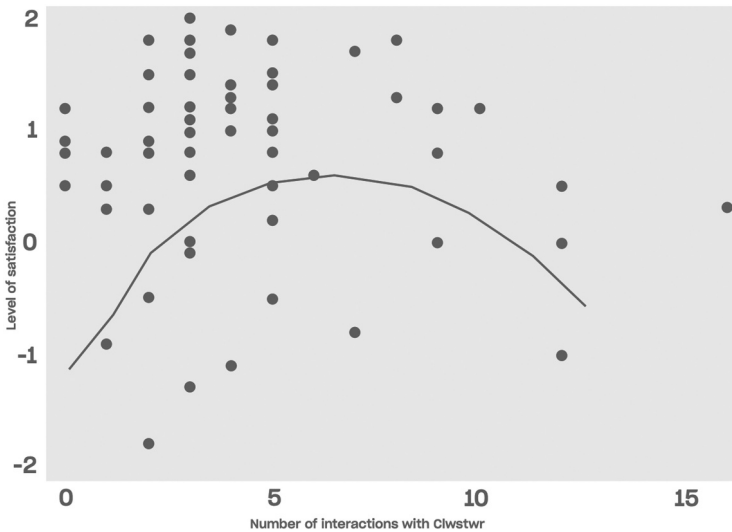


Figure 4.2 Scatterplot relating satisfaction levels reported by projects at the end of their R,D&I support (at the end of Quarter 4) and the number of interactions that they have had with the support provided.

Table 4.3 Regression output from running the specification in Equation 4.2.

		Regression coefficient	Standard error	t-score
Total support sessions with Clwstwr		0.132	0.099	1.34
Squared number of total support sessions with Clwstwr		-0.011	0.007	-1.56
Constant term		0.457	0.260	1.76
Number of observations	68			
R-squared	0.04			

projects. Projects that engaged at a moderate level showed higher satisfaction, supporting the idea that external support should enhance, not replace, internal capabilities. This finding highlights the importance of a balanced approach to support, where too much or too little interaction can be detrimental.

We should note, at this point, that the decrease in satisfaction associated with much higher levels of interaction may be a product of an attempt by the Clwstwr support team to ‘rescue’ or ‘fix’ projects that were encountering problems or difficulties. In other words, higher levels of

intervention were a symptom rather than a cause of lower levels of satisfaction.

The importance of a balanced approach to support is expressed by Amplyfi, a project using AI to fast-track investigative journalism. As the lead on their R&D project explained:

Clwstwr was great because it has put us in touch with so many people. We've been in touch ever since with our producer and it feels like they are still supportive even if the project is officially over. They (CO-Is) were also always very helpful and responsive. I think that the Clwstwr project made the relationship to Higher Education Institutions more productive.

The manager of the Aomame project also expresses the idea of balanced support, encapsulated in the phrase 'I got advice when I needed it':

The Clwstwr team is brilliant, really supportive. I got advice when I needed it. You really felt they were behind you and rooting for you.

In terms of the timing of milestones reached, the results from running the specification in Equation 4.1 are provided in Table 4.4 below.

The only two regressions that are statistically significant are the number of milestones reached in Quarters 1 and 2 of the project. They imply that reaching one additional milestone in Quarter 1 of the project, holding all other things constant, decreases satisfaction at the end of the project by 4%. On the other hand, reaching one additional milestone in

Table 4.4 Regression output from running Equation 4.1 with the natural logarithm of satisfaction levels at the end of the project as the dependent variable.

	<i>Regression coefficient</i>	<i>Standard error</i>	<i>t-score</i>
Milestone reached before contract signature	-0.001	0.022	-0.06
Milestone reached in the 1st quarter of the project	-0.042	0.018	-2.31
Milestone reached in the 2nd quarter of the project	0.033	0.19	1.72
Milestone reached in the 3rd quarter of the project	-0.010	0.015	-0.65
Milestone reached in the 4th quarter of the project	0.013	0.017	0.78
Milestone reached after the end of the project	-0.022	0.013	-1.64
Constant term	1.36	0.08	16.05
Number of observations	68		
R-squared	0.14		

Quarter 2 of the project, holding all other things constant, increases satisfaction at the end of the project by 3%.

The theory of planned behaviour and innovation diffusion theory is supported by the importance of hitting milestones. Early achievements in Quarter 2 boost satisfaction, validating the project's direction and fostering a sense of progress. This aligns with the idea that perceived usefulness and ease of use are crucial for the adoption and success of innovations. Organisational learning theory is reflected in the negative impact of premature milestones. Early achievements may disrupt the iterative learning process, leading to reduced satisfaction. This underscores the need for a paced approach to innovation, allowing for continuous learning and adaptation.

The Gogglesminds and the Democracy Box projects (which both had successful outcomes) are examples of the success of a well-paced R&D project. Gogglesminds deployed VR to transform the healthcare education system. Throughout the two rounds of funding, the company progressed steadily through the research process. The manager of Gogglesminds explained:

I would say, we did hit some roadblocks quite early on, which was good in hindsight, because we were able to kind of rectify those. I wouldn't say the major ones (at the start), I would say sort of here (second quarter) and it kind of probably went like this for like a month or two (pointing at the graph). Because we thought initially that we solved it but actually didn't, someone else provided feedback on this and it's like: Oh OK, we didn't think about that. Actually what happened, towards the end is we built the platform, people were using it, and we were getting really, really good feedback, really good results. We could see actually what was happening was that we created something that people do find useful.

The Democracy Box project explored novel ways to develop democratic participation by co-creation with young people normally disengaged from politics. As the manager of the Democracy Box explained:

The project allowed me to take my work into a different sector. I can't quite explain the impact of that. I didn't even know there was a democracy sector. It allowed me to research that, map that and create a bridge from the arts & cultural sector to democracy. I'm not pioneering that but I didn't know that I could do that. I am only just at the beginning of what that could become. If I do what I am trying to do now I am going to create a 12-month talking shop that would employ creative freelancers, as the hosts of it for a year or more and open satellite ones all over Wales. I will take other creatives with me into this other sector. What is really important is that their worth is really valued outside and in different sectors.

Conclusions

The findings from this analysis of R,D&I projects offer a data-driven perspective on how future public funding programmes can be strategically organised to optimise their impact on creative industries' innovation. The journey through funding allocation, support interaction, and milestone achievements reveals a number of lessons for successful creative industries' innovation ecosystems.

Firstly, the relationship between engagement with the support body and project satisfaction follows the 'Goldilocks' principle – not too much, not too little, but just right. Those who had either very regular or very infrequent interaction with the support personnel reported lower levels of satisfaction compared to those who maintained a reasonable degree of relationship. This indicates the existence of an optimal point where the desired outcomes are facilitated by the appropriate level of supportive engagement (Gong et al., 2013). Insufficient interaction can lead to a lack of guidance and support, while too much interaction may indicate too much reliance on others, hindering independent thinking and decision-making. It may be, as we have suggested, that higher levels of support were indicators of – rather than a cause of – projects less likely to succeed. Either way, it suggests that providing additional support in these instances has far less impact.

This finding challenges the model of hands-off funding, advocating an intervention strategy that provides critical guidance and support that enables projects to progress – without doing too much of the work for them. Once a project becomes too dependent on intervention and support, there is a law of diminishing returns in terms of time and resources spent. To provide the right level of interaction means offering guidance, feedback, and resources without compromising the autonomy of projects. This balanced engagement fosters a supportive environment where creativity and innovation can flourish organically, a system of 'smart support', allocating resources where they can make the most significant impact. This means providing enough support to empower innovation without fostering dependency or complacency.

Secondly, the timing of support emerges as a factor in project success. Our findings suggest that hitting milestones too early can be detrimental, as it may disrupt the natural learning and development processes inherent in R&D projects in the creative industries. Our regression analysis reveals a subtle connection between project satisfaction and the timing of milestone achievements. Projects that fulfilled targets relatively early were associated with higher satisfaction, suggesting that early successes can boost confidence and momentum (Edler et al., 2013). However, achieving these milestones too quickly may paradoxically lead to reduced satisfaction, as their rushed nature undermines the depth and quality of creative exploration. This highlights the importance of timing and pacing in the

support process to achieve a balance between initial achievements and continuous growth. This may be a consequence of projects moving too quickly towards a specific solution, thereby closing off other (potentially more promising) avenues to explore. This indicates the value of strategic pacing – encouraging projects to achieve significant early milestones while allowing enough time for iterative learning, refinement, and potential changes in direction.

This suggests the need for funding strategies that prioritise medium-term innovative potential over short-term economic metrics in the creative industries' innovation ecosystem. By focusing on milestones that build intellectual capital and innovation capabilities, funding bodies can ensure that projects are more successful. Future programmes should embrace the inherent uncertainty and variability of R,D&I projects in the creative industries, offering tailored support that adapts to the unique needs and trajectories of each project and the sector. This approach not only ensures that a broader spectrum of R,D&I in the creative industries receives support but also fosters an environment where unconventional and high-risk projects can thrive. Inclusivity means recognising underrepresented innovation types (see also Chapter 3), ensuring that innovation is not just widespread but also diverse and equitable. This involves creating pathways for ongoing support, such as follow-up funding, continued mentorship, and robust networking opportunities (like Clwstwr aimed to establish). By doing so, funding bodies can help projects transition from public support to financial independence, ensuring that the initial investment generates lasting value and impact in R,D&I in the creative industries.

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