



AN INTRODUCTION TO RESEARCH AND INNOVATION POLICY FOR REGIONAL GROWTH

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About UCI

The Policy Evidence Unit for University Commercialisation and Innovation (UCI) is based at the University of Cambridge and aims to support governments and university leaders in delivering a step change in the contributions universities make to innovation and economic prosperity – nationally and locally – through their commercialisation and other innovation-focused knowledge exchange activities and partnerships.

UCI seeks to improve the evidence base and tools available to key decision makers in public policy and university practice as they develop new approaches for strengthening university research-to-innovation pathways, with a particular focus on commercialisation. To do so it draws on the latest advances and insights from both academic research and policy practice, as well as lessons learned from experiences in the UK and internationally.

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Introduction

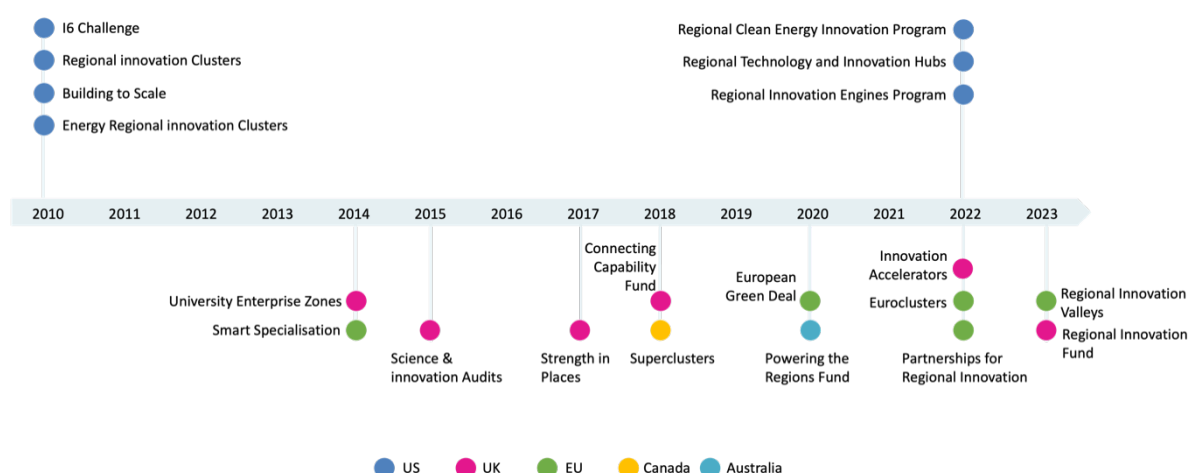
1 Introduction

The UK exhibits amongst the highest interregional productivity inequalities in the industrialised world (McCann and Yuan, 2022). London and the Southeast (and to a lesser extent Scotland) display strong productivity growth, while parts of the Midlands and the North of England, Wales and Northern Ireland do not. These disparities have contributed to national productivity now being around 16% lower than that of the US and Germany. They are also reflected in large interregional differences in wellbeing measures (e.g. quality of life, civic engagement, town-centre viability, health and life expectancy) (McCann, 2016). Disparities have widened over time across the UK as both the number of places doing well and those ‘left behind’ have increased (HM Government, 2022).

A consensus has emerged in recent years across consecutive governments that improving national economic growth depends on increasing the economic performance of cities and towns outside London and the Southeast (Ulrichsen and O’Sullivan, 2020). The most recent expression of this consensus is the current UK Government’s mission-driven approach to government, the critical mission being to unleash the full potential of all UK cities and regions by enabling existing services and manufacturing sectors to adapt and grow while seizing opportunities to lead in new and emerging sectors (HM Government, 2024a).

In this, the UK is following a resurgence of interest in place-based, place-sensitive, and mission-oriented R&I approaches to drive regional growth (Figure 1). This represents a shift from the space-blind funding model traditionally used by UK Research and Innovation (UKRI) which sees funding allocated based on ‘excellence’ criteria wherever it is located (McCann, 2019; Ulrichsen and O’Sullivan, 2020). Initial efforts in this area, e.g. the Strength in Places Fund, Connecting Capability Fund, and Regional Innovation Fund, have adopted place-based principles to maximise regional potential for economic performance.

Figure 1 | Timeline of selected place-based or-sensitive R&I policy instruments




To assist policymakers in this area, this report discusses the theories and practical approaches to regionally focused R&I policy, drawing both on established good practices and emerging thinking. It provides an introduction into the topic of how R&I policy can incorporate a regional focus to enable investments in local R&I systems that drive local economic benefits. Based on desk research, it

brings together key insights from economics and economic geography, international approaches to regionally focused R&I policy design and implementation in the US and EU, and the current UK government's focus on industrial and devolution strategies.

Chapter 2 introduces key types of growth that can be selected as policy objectives. It also includes a discussion of different growth theories which have historically informed policy thinking concerning how growth(s) should be achieved.

Chapter 3 charts the separate evolutions of development policy and R&I policy, and the different growth theories these have drawn upon. It also discusses their increasing co-evolution which has seen a recent resurgence and rethinking of regionally focused R&I policy approaches.

Chapter 4 develops a strategic approach for the orientation, design and implementation of regionally focused R&I policy. It highlights thinking from key international policy programmes, including the EU's Smart specialisation, European Regional Development Fund, and Innovation for Place-based Transformation, the US Regional Innovation Engines, and the UK Strength in Places Fund.



Growth types and growth theories

2 Growth types and growth theories

This chapter introduces key types of growth that can be selected as policy objectives and the different growth theories which have been influential in policy thinking about how growth(s) should be achieved.

2.1 Types of growth

Economic growth refers to continued increases in the size of the economy or sustained increases in outputs, typically measured as variation in gross domestic product (GDP) (Rocha, Kunc and Audretsch, 2020). It is applied to those areas where GDP is greater than that of a pool of 'industrialised' territories, while the related term 'economic development' refers to areas where GDP is less than the level considered necessary for the satisfaction of basic human needs (Muzhani, 2014).

Conceptualisations of growth as an increase in GDP are increasingly being challenged. This has seen an increasing emphasis on other forms of growth as policy objectives, and on the complementarities and contradictions between them which influences policy design and implementation (Rodríguez-Pose, Dijkstra and Poelman, 2024). These other types of growth include:

- Inclusive growth involving the participation of a majority of citizens in the decision-making and benefits sharing of the growth process (Boarini, Murtin and Schreyer, 2015)
- Sustainable growth meeting the needs of present generations without compromising the ability of future generations to meet their own needs (Jacobs and Mazzucato, 2016)
- Resilient growth refers to the concept of regional economic resilience, whose meaning encompasses territorial abilities to bounce back from or absorb shocks, or to positively adapt or engage in system transformation in anticipation of shocks (Martin and Sunley, 2020).

2.2 Growth theory

Growth theory includes a range of models and theories that seek to explain the process by which economies grow and develop over time. A number of theories which have been influential in policy thinking are introduced below, together with the growth drivers emphasised within.

2.2.1 Classical economics

Classical economics includes different schools of thought that view market economies as largely self-regulating systems, governed by natural laws of production and exchange. Adam Smith argued that national prosperity was driven by three production factors: land as a natural resource and source of rent, the division of labour into more specialised tasks to enable greater efficiency and productivity, and capital (i.e. tools, machines, buildings, and money) used to produce goods and services, and accumulated through savings and reinvestment (Smith, 1776). Countries or firms could benefit from free trade where they held an absolute advantage in being able to produce more of a good or

service using the same amount of resources, or the same amount using fewer resources, compared to competitors. The best way to optimise resource allocation for wealth creation was not through government planning, but via the 'invisible hand', where self-interested individuals in free markets unintentionally promote society's good through price mechanisms and competition. Limited state intervention is only justified in areas where the market is not the best way to serve the common interest, such as defence, justice, and public works.

The Ricardian school shares the view of the importance of national endowments of land, labour, and capital, but differs in emphasising that an absolute advantage is not necessary to benefit from trade (Ricardo, 1817). A comparative advantage is sufficient, whereby countries specialise in the production of goods and services in which they are more efficient compared to other goods and services, and relatively more efficient than other countries. Factor endowments are moulded by historical, path-dependant processes and evolve slowly over time, making it difficult for competitors to emulate them (David, 1994; Maskell, 1999; Zysman, 1994).

2.2.2 Keynesian economics

Keynesian economics sees changes in aggregate demand (i.e. the sum of household, business, and government spending) as having the greatest short-run effect on economic growth (Keynes, 1936). As market economies progress through cycles of expansion and contraction, the resulting volatility in aggregate demand contributes to recessions (low demand) and inflation (high demand).

Government intervention is justified to moderate these fluctuations and can include countercyclical fiscal policies (e.g. increased government spending to stimulate employment and stabilise wages during recessions) and monetary policies (e.g. reducing interest rates to encourage investment).

Keynesian economics displaced classical economics and came to dominate policy thinking after World War II. It waned in the 1970s as it proved unable to deal with simultaneous inflation and slow growth (stagflation) being experienced by many advanced economies at the time.

2.2.3 Supply-side economics

Supply-side economics argues that economic growth is driven by lowering barriers to production rather than by increasing demand and emphasises policies to increase the supply of goods and services through increased production and business activity (Canto, Joines and Laffer, 1983; Roberts, 1984).

The approach gained prominence in the 1970s in response to stagflation. Key growth drivers include lower tax rates to incentivise work, savings and investment, deregulation to lower compliance costs and barriers to entry, capital investment in equipment, technology, infrastructure and R&D, and labour market flexibility and mobility.

2.2.4 Neo-classical economics

Neo-classical growth theory explains long-run economic growth as the output of a production factor involving three input variables: capital, labour and technology (Solow, 1956; Swan, 1956). Firms aim to maximise profits over time by choosing optimal levels of capital, labour, and technology inputs. There are diminishing returns to capital accumulation and labour force growth, so that over time the production factor reaches a steady-state equilibrium with no economic growth. However,

technological progress increases labour productivity and therefore enables a permanent rate of growth to be achieved. Technological progress includes advances in technological, managerial, and organisational knowledge which enable lower production costs, as well as economies of scale and human capital factors (Denison, 1980).

The neo-classical growth model revolutionised economics, enabling a shift from mechanistic supply and demand growth models to a dynamic model of permanent growth. A central criticism is that it treats technical progress as the result of external (exogenous) forces acting on an economic system and assumes this improves at a constant rate without explaining why or how (Barro, 1987). Other criticisms include unrealistic assumptions of rational profit-maximising firms and homogenous firms, economic equilibria, and perfect information (Nelson and Winter, 1982).

Although neo-classical growth theory largely ignores the role of geography in economic growth (Kitson, 2019), its convergence hypothesis that technological progress enables poorer territories further away from their steady state to grow faster and converge over time with more developed territories has implications for regional policy (OECD, 2009a).

2.2.5 Endogenous growth theory

Endogenous growth theory addresses the exogeneity criticism of neo-classical growth theory by offering an endogenous (i.e. within the economic system) explanation of the factors which influence technological progress (Romer, 1990, 1994). Essentially, technology provides an incentive for capital investment and accumulation within the system because it is non-rivalrous (use by one actor does not limit use by others) and partially excludable (access to the technology can be limited to some extent). Accumulation of rivalrous knowledge occurs through learning by doing within the system, enabling continuous performance improvement (Arrow, 1962). International trade is also important in diffusing knowledge through the system.

This theory specifies 'human capital engaged in research' as the key factor behind technological progress, and consequently as a growth driver itself (Bonvillian, 2024). This emphasises the importance of the reallocation of labour from production and consumption to technological research and advancement rather than total labour available or the proportion of total labour trained to engage in research.

From a regional policy perspective, endogenous growth theory is important because it emphasises the role in knowledge diffusion of localised spillovers – i.e. where firms benefit from the R&D efforts of other firms that are in close technological proximity (Feldman, 1999). This suggests that technology investments can improve economic growth if the correct places to support can be identified (Kitson, 2019). Further, certain territorial characteristics can shape divergence in growth rates over the long run, and these can include stocks or continued accumulation of R&D human capital (Lucas, 1988; Nelson and Phelps, 1966). A related development, the Marshall (1920) – Arrow (1962) – Romer (1986) (MAR) framework, maintains that territories with a high degree of specialisation in a specific industry benefit most from spillover effects and experience more innovation and higher growth.

2.2.6 Evolutionary economics

Providing an alternative to neo-classical growth theory's emphasis on profit maximising firms and equilibria, evolutionary economics focuses on more realistic microeconomic processes of technical change (Nelson and Winter, 1982). Firms possess various capabilities, routines, and decision rules that enable them to adapt to changing market dynamics by searching for new ways of doing things. Successful adaptations can create competitive advantage and increase productivity. Firms also exist in a selection environment which enables diffusion of successful adaptations through firm growth, imitation, and industry structuring, with unsuccessful adaptations leading to firm contraction and Schumpeterian creative destruction. This can ultimately lead to increases in economic growth.

Evolutionary economics broadens endogenous growth theory's focus on 'human capital engaged in research' to 'human capital engaged in research and development' as a key driver of growth (Bonvillian, 2024). This emphasises both the rich and complex interactions between science and technology necessary for innovation and the importance of a dynamic innovation system to enable these interactions to happen. A range of factors indirectly influence system dynamism, including both public sector (e.g. fiscal/tax/monetary policy, trade policy, IP protection, technology standards, technology transfer policies, public procurement, legal and regulatory systems, export controls) and private sector factors (e.g. investment capital, markets, talent hiring, compensation, and rewards).

Of relevance to regional policy, geography is seen as being important to the innovation process for two reasons (Asheim and Gertler, 2009). First, actors engage in interactive learning processes to communicate and cooperate in the joint creation and utilisation of new, economically useful knowledge (Lundvall, 2012). These processes are particularly suited to face-to-face interactions and trust-based relationships which are more often found within specific geographies. Second, the knowledge created through interactive learning includes tacit knowledge – i.e. that which is intuitive, defies easy articulation, or cannot easily be codified (Hedlund, 1994; Polanyi, 2002). This is spatially 'sticky' and easier to exchange between actors who share a common language, codes of communication, and norms, fostered within a shared institutional environment (Lam, 2000).

2.2.7 New economic geography

New economic geography (NEG) offers an explanation for why economic activity tends to concentrate in certain geographical locations (agglomeration), why territories specialise in particular industries, and how this could lead to a divergence between two similar territories over time into a core-periphery pattern (Krugman, 1991, 1992). Core territories are highly productive, producing globally tradable goods and services, while peripheral territories possess low productivity and produce outputs aimed at local markets.

Concentrations of economic activities represent an equilibrium between centripetal and centrifugal forces encouraging agglomeration or dispersion respectively. Centripetal forces include firm-level economies of scale available in a given location, the size of domestic markets, backward and forward linkages (i.e. firms locating near suppliers and customers), labour mobility, and external economies arising through localised knowledge spillovers. Centrifugal forces include price levels for intermediates, wage levels, and interterritorial competition. Transportation costs can influence this equilibrium towards dispersion or agglomeration. Differences between territories' 'fundamentals', including endowments of natural resources, labour pools and the quality of local institutions, also act as sources of regional comparative advantage which encourages agglomeration (Krugman, 2005).

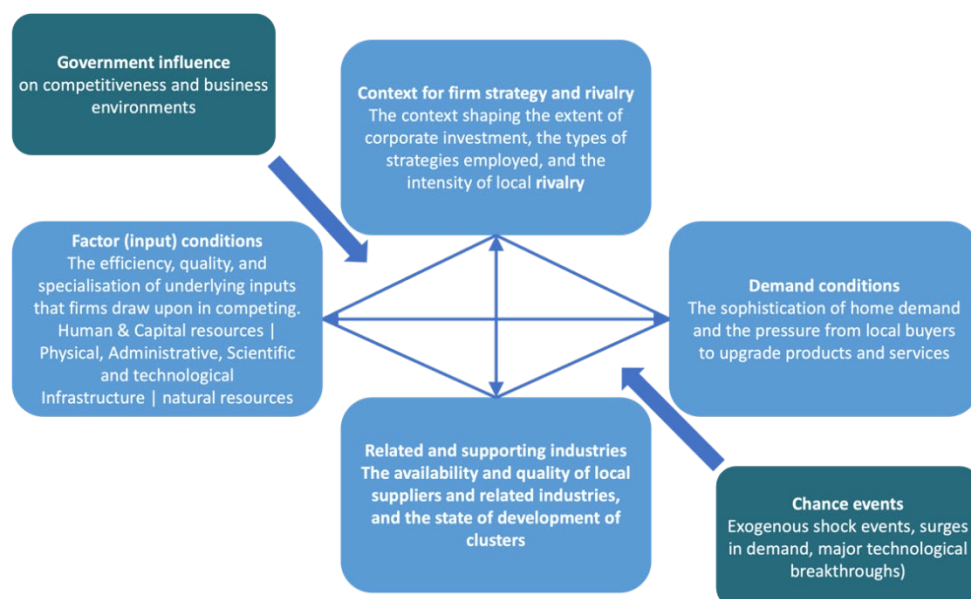
Unlike neo-classical or endogenous growth theories, NEG emphasises agglomeration and scale effects as key growth drivers (OECD, 2009a). Small structural changes in territorial economies offer firms locational advantages, e.g. sharing of risk and resources between firms; matching between firms, workers, and partners; and learning (Duranton and Puga, 2004). This encourages localised knowledge spillovers which enable productivity increases and enhance territorial comparative advantage – i.e. where a territory specialises in activities in which they are more efficient compared to all other activities that could be undertaken. This in turn encourages greater agglomeration, leading to a self-feeding mechanism of circular causation which sees increasing returns over time that eventually lead to large regional divergences in economic performance (Krugman, 1987).

2.2.8 Cluster theory

Cluster theory emphasises how economic vitality and regional competitiveness depend on the creation and strengthening of ‘clusters’ – i.e. geographic concentrations of interconnected businesses, associated industries, and specialised institutions (e.g. universities) that compete and cooperate in particular fields of specialisation (Porter, 1990, 1998a, 1998b, 2003).

Key growth drivers are competition and a specific type of agglomeration known as a ‘localisation economy’. This offers cluster firms locational advantages, e.g. concentrations of specialised assets, suppliers, infrastructures, and labour; sector-specific knowledge spillovers; resource-sharing; and economies of scale. Availing of these advantages enables firms to continually adapt and upgrade themselves, developing capabilities to compete in more productive industry segments and sophisticated new sectors, and in attracting foreign investment. Industries that trade both across the region and internationally are particularly important as they increase regional productivity, shape future productivity growth, stimulate new business creation, and drive wage growth and increased regional standards of living overall. However, the impact of high-technology clusters on a regional economy is usually relatively small.

Figure 2 | The diamond model of the business environment



(Source: adapted from Porter, 1998a)

Increasing productivity through more sophisticated ways of competing depends on parallel changes in the regional microeconomic business environment. This is made up of four interrelated areas represented in a 'diamond model': the quality of factor (input) conditions, the context for firm strategy and rivalry, the quality of local demand conditions, and the presence of related and supporting industries (Figure 2). Chance events (e.g. exogenous shock events, surges in demand, major technological breakthroughs) and government influence on competitiveness also influence the business environment.

2.2.9 Urbanisation economics

Urbanisation economics explains how cities and urban areas influence economic growth, development, and human behaviour (Jacobs, 1970).

The approach shares elements with cluster theory, such as a focus on competition as a driver of productivity and economic growth. However, it differs in seeing a type of agglomeration known as an 'urbanisation economy' as a growth driver. Urbanisation economies offer different locational advantages than localisation economies, e.g. scale and diversity of industries and sectors, wide ranging ideas for new innovation, general infrastructures and a broad base of useful resources, a broad labour market with alternative skills relevant to the development of new kinds of business, large consumer base, and better access to capital. These may enable industries to innovate more, grow faster and overcome industry specific pitfalls in urbanised locations.

2.2.10 Dynamic comparative advantage theory

Classical economics has been criticised by Porter (1990) and others on the grounds of its static nature, its assumption of the fixed nature of land, labour, and capital endowments, its neglect of economies of scale, and its neglect of firm strategy.

An approach which addresses these criticisms is dynamic comparative advantage theory (Grossman and Helpman, 1991; Haskel and Westlake, 2018; Krugman, 2009; Maneschi, 1998). This approach emphasises territorial endowments of a broader set of tangible and intangible fixed assets as the tools, knowledge and equipment used to produce goods and services (see Appendix A).¹ But it also recognises that firms constantly need to upgrade and reconfigure their competitive advantage in the face of changing market and competitive conditions. This requires a range of capacities and capabilities at different levels (e.g. firm, regional) necessary to dynamically combine and configure these assets so that they interact to produce long lived streams of productive services known as 'capitals' (see Appendix B).

This means that at a regional level, competitive advantage and comparative advantage (emphasising respectively absolute and relative advantages in production and innovation) are complimentary and move through cycles (Martin and Sunley, 2011). A region's initial comparative advantage becomes undermined as competitors with greater comparative advantage emerge, putting pressure on regional firms to recreate comparative advantage in their industry by exploiting competitive advantages based on innovation and collective learning. This cycle drives regional growth.

¹ Fixed assets are economic resources expected to provide benefits over a period of time and which use up resources in their production (Haskel and Westlake, 2018).

Dynamic comparative advantage theory can be regarded as more general than cluster theory and subsumes the latter (Martin and Sunley, 2011).

2.2.11 Institutional economics

institutional economics sees the quality and capacity of territorial institutional arrangements to capture or attract economic activity as the key growth driver. Local, regional, and national institutions are seen to interact to shape economic behaviour, resource allocation, and technological innovation. These institutional arrangements include property rights, legal and regulatory frameworks, political stability, quality and type of governance, and political trust (Acemoglu, Johnson and Robinson, 2001; Muringani, Fitjar and Rodríguez-Pose, 2024; Rodrik, 2005; Rodrik, Subramanian and Trebbi, 2004; Storper, 1997).

Proponents regard institutional arrangements as being of greater importance to regional economic performance than NEG and cluster theory's emphasis on geography because these arrangements not only shape the networks and processes that drive economic activity but can also undermine development efforts where lacking (Rodríguez-Pose et al., 2024). However, developing an institution-based regional development strategy is difficult because of issues related to institutional definition, measurement, and space and time variability, to the difficulties in establishing the right mix of formal and informal institutions, and to the endogeneity between institutions and economic development (Rodríguez-Pose, 2013).

2.2.12 Progressive theories of growth

A number of more progressive growth theories and models have emerged as alternatives to approaches which prioritise GDP increases as the key policy objective.

Modern supply-side economics (Yellen, 2022), also known as productivism (Rodrik, 2023), constitutes an evolution in supply-side thinking, addressing its failure to deliver promised growth or address social and spatial inequalities, ecological degradation and political marginalisation. It emphasises the dissemination of productive economic opportunities throughout all regions of the economy and segments of the labour force, with growth and development drivers including technological advancement and capital accumulation. This differs from both a Keynesian redistributive welfare state model's focus on expanded social welfare programmes and traditional growth strategies' focus on innovation systems, intellectual property rules, appropriate regulatory structures, and export and innovation incentives for the most productive segments of the economy (Figure 3).

Economics for the common good emphasises that economics should serve society by helping to solve major social, environmental, and institutional challenges while balancing market forces with the common good (Tirole and Rendall, 2017). Growth drivers include innovation, capital accumulation based on long term investment, fair labour markets, and democratic institutions. The role of the state and governance arrangements in prioritising and accelerating innovation in collectively agreed directions is also emphasised (Mazzucato, 2023).

Figure 3 | Different types of approaches to prosperity and inequality

		At what stage of the economy does policy intervene?		
		Pre-production	Production	Post-production
In which segment of the economy does policy intervene?	Low productivity	Investments in education and training		Transfers; Full employment macro policies
	Middle productivity		Promotion of higher-quality jobs in SMEs; Employer-linked training; Customised business incentives & services; Labour-friendly innovation policies	Social insurance; Pensions; Safety nets
	High productivity	Innovation systems; IPR rules; Trade agreements	Market-friendly regulations; R&D and export incentives	Corporate tax incentives

Key
Keynesian welfare distribution
Modern supply-side economics
Traditional growth strategies

(Source: adapted from Rodrik, 2023)



Evolution of R&I policy and development policy

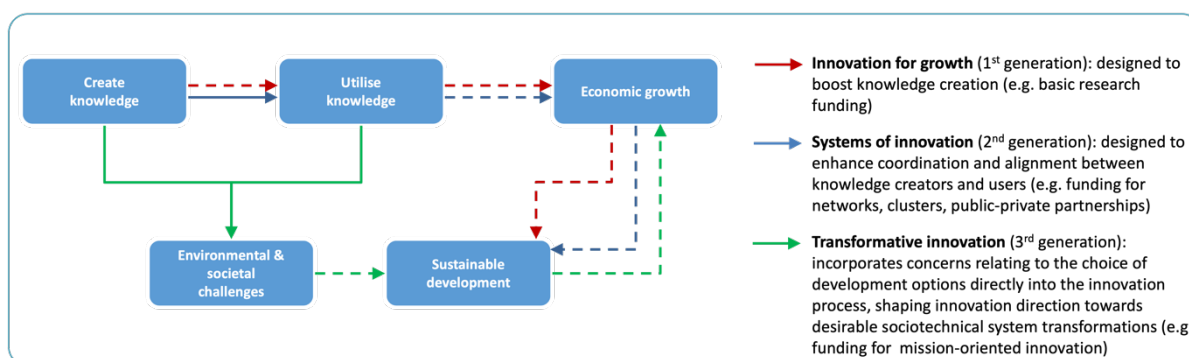
3 Evolution of R&I policy and development policy

Different growth theories have informed policy thinking over the years to better understand past experiences, reflect on contemporary challenges and understand potential for future action. In this chapter, we chart the separate evolutions of both development policy and R&I policy, and their increasing co-evolution which has seen a recent resurgence of regionally focused R&I policy approaches.

3.1 Evolution of R&I policy

The evolution of R&I policy has been influenced by four main theoretical perspectives: neo-classical economics, evolutionary economics, systems theory and progressive growth theories (Chaminade and Edquist, 2010; Schot and Steinmueller, 2018). These have given rise to distinct policy framings, with the instruments designed under each framing being used to complement rather than replace each other (Daimer, Hufnagel and Warnke, 2012).

Figure 4 | R&I policy framings



(Source: adapted from Daniels et al., 2020)

3.1.1 Innovation for growth

Within neo-classical growth theory (Section 2.2.4), the innovation process is seen as a 'linear model' – i.e. a fixed sequence of phases where research efforts will turn almost automatically into new products (Balconi, Brusoni and Orsenigo, 2010; Chaminade and Edquist, 2010). Knowledge created through research is codifiable through language or mathematics, making it easy to move along the innovation process, but has certain characteristics:

- Uncertainty – it is impossible to fully know the outcomes of the research process and the associated risks
- Inappropriability – firms cannot fully appropriate the benefits which derive from their inventions, and this disincentivises research activities
- Indivisibility – a minimum investment in knowledge is required before any new knowledge can be created.

Table 1| Market, system and transformative system failures

Failure type	Failure	Description
Market failures	Information asymmetries	Differences in the information available to knowledge producers and users leading to power imbalance, suboptimal decision-making, and precautionary behaviours (e.g. short time horizons, sub-optimal levels of private sector investment in R&D)
	Externalities (e.g. knowledge spillovers)	Arising where the technical characteristics of a good or service prevent property rights from being established or enforced, disincentivising private sector investment in R&D because not all of the benefits of innovation investments can be captured
	Market power	The ability of companies to extract 'rents' over and above the level of income that would have been available under 'perfect' competition, e.g. monopolies, companies exploiting economies of scale or scope. Market power may increase the likelihood that a firm can capture benefits from innovation investments (positive effect), but too much market power can act as a break on innovation (negative effect).
System failures	Institutional failures	Hard institutional failures include the absence, excess or shortcomings of formal institutions such as laws, regulations, and IPR standards. Soft institutional failures include conflicts between competing cultural norms and values
	Network failures	Hard network failures arise through overly strong linkages between actors, leading to a lack of infusion of new ideas, locking technological change into established trajectories. Soft network (or complementarity) failures arise through weak or missing network linkages which limit best practice diffusion and hamper mutual learning and awareness of complementary knowledge and assets. Weak/missing linkages may be necessary to unlock the full functionality of an innovation, meaning potential positive effects may not be realised
	Lock-in failures	Organisations/regions may be excessively focussed on existing technological trajectories, and face large barriers to adopting new technologies. Lock-in could be caused by very high upfront infrastructure costs associated with new technology adoption, weak coordination between different system organisations required to deploy and diffuse a technology, or cultural aversion to change
	Infrastructural failures	Absence of scientific, physical, and network infrastructure to increase coordination and learning within systems, due to large-scale, long-time horizon of operation and ultimately too low return on investment for private investors
	Capability and learning failures	Lack of appropriate competencies/resources at individual or firm level prevent access to new knowledge, leading to an inability to adapt to changing circumstances, open up novel opportunities, or switch to a new technological trajectory
	Unbalanced exploration-exploitation mechanisms	Systems may lack either the capability to generate the diversity / variety of technological options (through creating new knowledge and ideas – exploration) or the ability to select from that diversity to pursue specific opportunities (exploitation)
	Transformative system failures	Directionality failures
Demand articulation failures		Insufficient spaces for anticipating and learning about user needs to enable adoption of innovations; absence of orienting and stimulating signals from public demand; lack of demand-articulating competencies
Policy coordination failures		Lack of horizontal, vertical and temporal coordination and coherence across different levels and areas of policy relevant to transformative change
Reflexivity failures		Insufficient system ability to monitor, anticipate and involve actors in processes of self-governance; lack of distributed reflexive arrangements to connect different discursive spheres; insufficient spaces for experimentation and learning; lack of adaptive policy portfolios to deal with uncertainty

(Source: Arnold et al., 2014; Chaminade, Lundvall and Haneef, 2018; Chaminade and Edquist, 2010; Weber and Rohracher, 2012; Woolthuis, Lankhuizen and Gilsing, 2005)

These characteristics result in a number of market failures which limit private investment in research (Table 1). These failures justify policy interventions to increase knowledge creation to economically and societally desirable levels. Interventions include funding for basic research, private sector R&D subsidies, patent protections, and support for venture capital. This understanding serves as the core of the 'Innovation for growth' policy framing which emerged after the Second World War (Schot and Steinmueller, 2018).

3.1.2 Systems of innovation

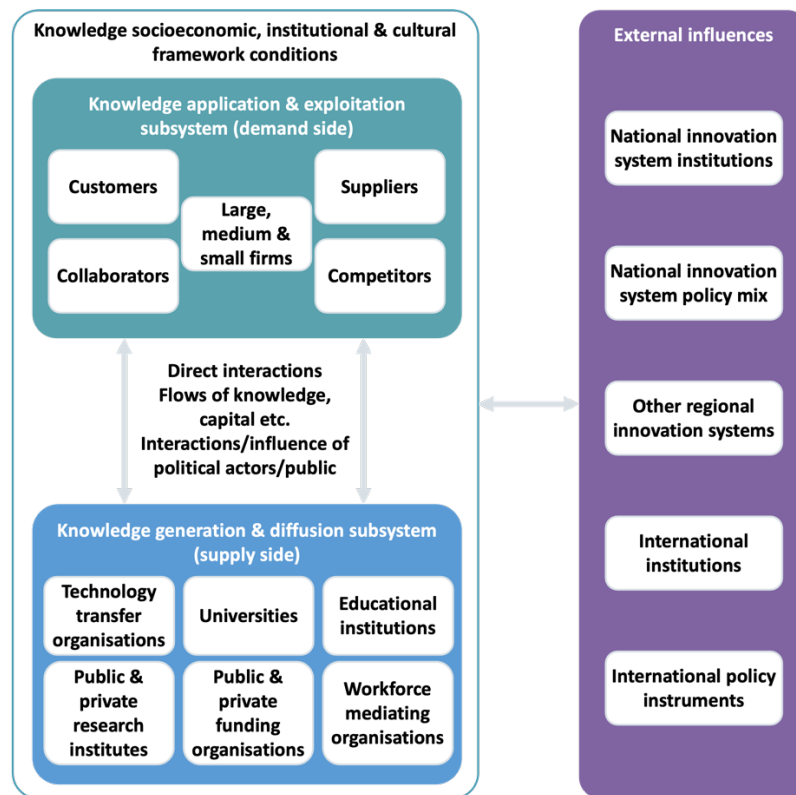
The 'Systems of innovation' (SI) policy framing has its roots in a number of theoretical approaches, including evolutionary economics (Section 2.2.6), systems theory, institutional theory, and sociology (Chaminade and Edquist, 2010). It came to prominence during the 1990s in response to perceived failures of 'Innovation for growth' to account for certain observations, such as the inability of many low-income countries to catch up with high income countries through technology transfer.

The SI approach defines an innovation system as a set of components and the causal relations influencing the generation and utilisation of innovations and the innovative performance (Granstrand and Holgersson, 2020). This shifts the focus from individual economic actors to collective actions within a system of actors. Firms innovate through continuous market- and non-market-based interactions with other organisations, including interactive learning processes (Edquist, 1997; Lundvall, 2012). Information asymmetries within the system help create variety from which successful adaptations diffuse within the selection environment.

Inherent difficulties in working across organisational boundaries (e.g. different motivations, incentives, formal and informal institutions, the complexity of innovation processes) give rise to system failures which weaken system innovative performance (Table 1). These provide rationales for policy interventions to strengthen system linkages, enhance entrepreneurship and coordination, and enable interactive learning (Smits and Kuhlmann, 2004). Interventions include public-private partnerships, innovation networks, clusters, enterprise zones, science parks, innovation districts, business incubators, seed capital programmes, and workforce skills development programmes.

Systems of innovation have been defined on several levels, and the regional innovation system (RIS) features prominently in policy discourse on regional economic growth (Asheim and Isaksen, 1997; Cooke, 1992). The RIS is the institutional infrastructure supporting innovation within the production structure of a region (Asheim and Gertler, 2009). It comprises two sub-systems: the supply-side and demand-side (Figure 5). The former consists of actors engaged in the creation of tangible and intangible assets and the dissemination of new ideas among regional actors. The latter consists of firms seeking to adopt, adapt, and apply complementary assets from the supply- and demand-sides or from other RIS to drive organisational objectives (Autio, 1998; Broekel, 2012; Stuck, Broekel and Revilla Diez, 2016). System dynamism is shaped by socioeconomic, institutional and cultural framework conditions as well as by external influences.

Figure 5 | Regional innovation system



(Source: adapted from Autio, 1998; Stuck, Broekel and Revilla Diez, 2016)

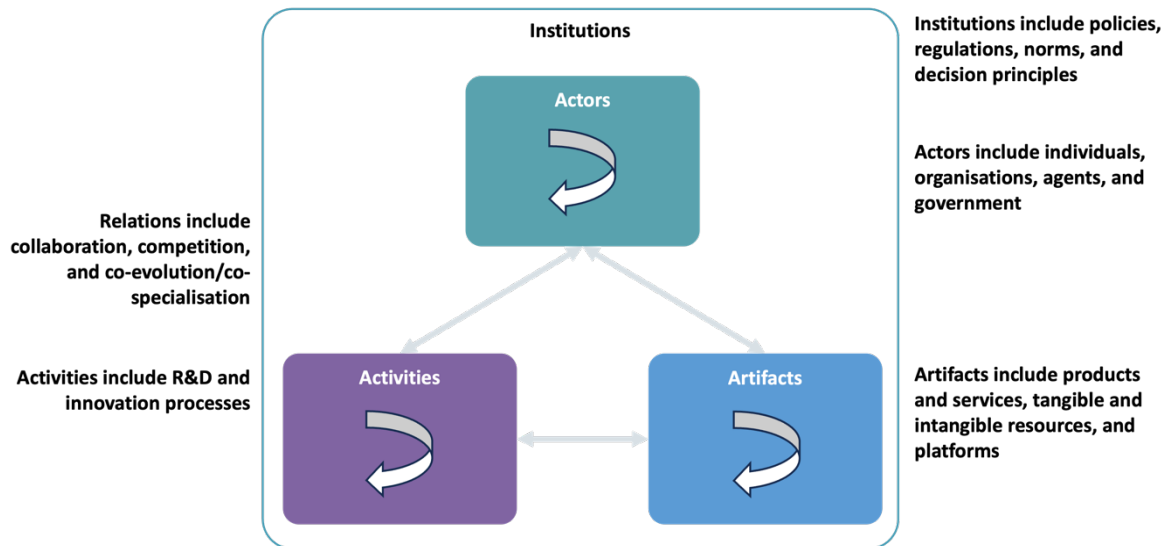
An emerging area of policy focus is the innovation ecosystem, recently defined as the evolving set of actors, activities, and artifacts, and the institutions and relations, including complementary (i.e. collaborative) and substitute (i.e. competitive) relations, that are important for the innovative performance of an actor or a population of actors (Granstrand and Holgersson, 2020) (Figure 6). Points of differentiation between ecosystems and RIS include the former being more explicitly systemic in highlighting links between diverse actors, more dependent upon open innovation, and more market-driven with less emphasis on government intervention (Oh et al., 2016).

3.1.3 Transformative innovation

The ‘Transformative innovation’ framing emerged in the 2000s through a recognition that science and innovation shaped by ‘Innovation for growth’ and ‘Systems of innovation’ frames underperformed in contributing to equitable and sustainable social, economic and environmental futures (STRINGS, 2022).

To address this, environmental and public welfare concerns were to be transformed into challenges representing opportunities for R&I policy to be explicitly addressed within the innovation process itself. It was assumed that public investments in clean technology missions can lead to green growth, reduce pollution, clean up the environment, and reduce inequality through new job opportunities, provided that investments are long term, policy capture can be avoided, and innovations effectively diffused through transformation of production and consumption systems.

Figure 6 | Innovation ecosystem



(Source: adapted from Granstrand and Holgersson, 2020)

Influenced by progressive growth theories (Section 2.2.12), this framing affords a more proactive role to government in addressing a range of transformative system failures (Table 1), enabling them to shape markets and coordinate a collective search for solutions aligned with agreed goals (e.g. the Sustainable Development Goals) (Grin, Rotmans and Schot, 2010; Markard, Raven and Truffer, 2012). It also broadens policy scope beyond national, regional, technological, and sectoral systems to encompass transformations of socio-technical (e.g. energy, mobility, water, waste), socio-institutional/economic (e.g. education, labour, finance) and socio-ecological systems (e.g. forestry, fisheries, agriculture) (Loorbach, Frantzeskaki and Avelino, 2017).

3.2 Evolution of development policy

In contrast to R&I policy, development policy thinking has historically been dominated by neo-classical economics (Section 2.2.4), resulting in growth strategies focused on a limited range of investments in infrastructure, human capital, and innovation (Barca, McCann and Rodríguez-Pose, 2012). Consequently, policy implementation tended towards a global proliferation of 'one-size-fits-all' approaches characterised by top-down decision-making and sectoral-focused supply or demand-side strategies, irrespective of differing regional (or national) contexts (Chien, 2008; McCann and Ortega-Argilés, 2016; Pike, Rodríguez-Pose and Tomaney, 2007).

By the late 1990s, weaknesses of this approach were increasingly apparent in the face of globalisation and its impacts, e.g. slow international convergence, eastward shifts in global trade, concentration of economic activity in super-regional geographies and global cities, and interregional growth disparities (Barca, McCann and Rodríguez-Pose, 2012). These highlighted both the increasing 'slipperiness' (capital, goods, people, and ideas travel more easily) and 'stickiness' (capital, goods, people, and ideas tend to concentrate in specific places) of space, which had largely been neglected within neo-classical economics. A debate ensued, concerning how economic geography should be incorporated within development policy, culminating in a series of highly influential international reports published in 2009 (Barca, McCann and Rodríguez-Pose, 2012; McCann, 2019).

3.2.1 Space-blind approach

The World Bank's World Development Report (2009) emphasised an apparent dichotomy between 'people-focused' and 'place-based' development policy logics. The former emphasised a space-blind approach which prioritised dominant and growing cities over weaker regions in order to maximise local agglomeration spillovers and their contribution to national growth (i.e. maximising efficiency). In the latter, national growth was seen as best served by fostering development in weaker regions with fewer agglomerations (i.e. maximising equity).

Drawing upon a range of growth theories which recognised the importance of scale economies, including new economic geography and endogenous growth theory (Sections 2.2.5 & 2.2.7), the World Bank's report advocated for the space-blind approach. It argued that this would ultimately lead to a more even geographical distribution of wealth and to convergence between less and more developed areas, as long as mobility of people to agglomerations and equal access to opportunities was encouraged. Moreover, place-based policies would inhibit national growth by failing to capitalise on agglomeration effects and by allocating resources inefficiently.

3.2.2 Place-based approach

Reports from both the OECD (2009b, 2009a) and European Commission (Barca, 2009) argued that the 'people-focused' versus 'place-based' dichotomy was false. Drawing upon institutional economics and new economic geography (Section 2.2.7 & 2.2.11), as well as empirical data from a range of different countries, these reports called for prioritisation of support for weaker and lagging regions on the grounds that this would contribute more significantly and sustainably to national growth and development.

Global policy thinking (including that of the World Bank) eventually shifted towards accepting the place-based approach, on the grounds that (Barca, McCann and Rodríguez-Pose, 2012; McCann, 2022; McCann and Ortega-Argilés, 2016; OECD, 2011a):

- This approach helps with the overall efficacy of national markets and policy, enables public resources to be used as both a 'carrot and stick' to catalyse innovation, maintains integrity and longevity of democratic market systems, and taps underutilised potential of smaller and less noticeable actors whose knowledge and social capital are vital for the diffusion of development benefits
- The space-blind approach always has explicit spatial effects which can undermine policy aims, has not always guaranteed development in the poorest countries, cannot effectively tap local potential, and incorrectly assumes the 'state knows best' and has sufficient information and knowledge to design and implement policy interventions.

Modern place-based development policy occupies a position between the 'people-focused' and 'place-based' logics, with efficiency and equity as twin overarching objectives (Barca, McCann and Rodríguez-Pose, 2012). Its logic is that centrally-provided public funding is provided to underwrite risks, tackle local 'underdevelopment traps', and re-align incentives of local public, private, and civil society sectors to facilitate more coordinated and collaborative actions that maximise the economic potential of a place, enabling convergence between less and more developed places (Barca, 2009; Barca, McCann and Rodríguez-Pose, 2012; Iammarino, Rodríguez-Pose and Storper, 2019; McCann, 2023).

Underdevelopment traps arise as a consequence of the path dependant development of a place's unique social, cultural, and institutional characteristics, and in particular poor institutions and governance, a lack of institutional alignment, non-collaborative or siloed governance, monopolies, or regions having the wrong institutions for the challenges faced. These traps inhibit regional growth potential and perpetuate social exclusion.

These traps are tackled by promoting flows of new knowledge and ideas between local groups and external experts (Barca, McCann and Rodríguez-Pose, 2012). Policy interventions are designed to give voice to bottom-up engagement and mobilise local actors and stakeholders through the principle of subsidiarity. Simultaneously, alignment and coordination are achieved through multi-level governance arrangements involving local, regional and national government working in partnership with private and civil society sectors.

Place-based policy interventions can include infrastructural funding as well soft support for businesses, networks, and credit availability (e.g. enterprise zones, cluster promotion, discretionary grants, and support for community development & locally led initiatives) (Neumark and Simpson, 2015, p.1205).

3.2.3 Place-sensitive approach

The place-sensitive approach is intended to counter potential negative effects of the geographical restrictions imposed by both the place-based (weaker and lagging regions prioritised) and space-blind approaches (dominant and growing cities prioritised) (Iammarino, Rodríguez-Pose and Storper, 2019).

Its goals are to maximise total future innovation output and long-term productivity growth of the economy in the aggregate as a hedge against the inherent uncertainty of innovation, to enable as many actors and regions as possible to participate productively in the economy, and to distribute capabilities for future development across as many territories as possible.

Table 2| Place-sensitive regional development strategies

Region type	Strategy
Very high income	Replace old activities with new ones on the technological frontier (sectoral succession) or continue to push the edge of innovation to maintain prosperity
High income	Develop regional firm capacity to generate incremental innovations within their areas of economic specialisation or move to areas linked within the economy, enabling the region to dominate high-quality segments and upstream tasks in more mature industries
Middle income	Escape the 'middle income trap' by re-skilling to increase productivity, labour-force participation, and firms' capacities, increasing inward investment and participating in global production and value chains networks
Low income	Transform underlying conditions (connectivity, state capacity, labour market skills and participation, entrepreneurship) to make the region more attractive for business

The approach has been used to distribute EU Cohesion Policy funding since 2014, enabling all EU regions to receive cohesion funding to ensure uniform implementation of overarching policy goals, though less developed regions have been the main beneficiaries (Suedekum, 2023). While regions of all types can benefit from resources allocated through this approach, these can be used to support very different types of development strategy (Table 2) (Iammarino, Rodríguez-Pose and Storper, 2019).

3.3 Co-evolution of development and R&I policy

An evolving interplay between understandings of the principles of the place-based approach and of how research and innovation contribute to economic growth and development processes is increasingly prominent in modern R&I policy (McCann, 2019). We highlight key developments below.

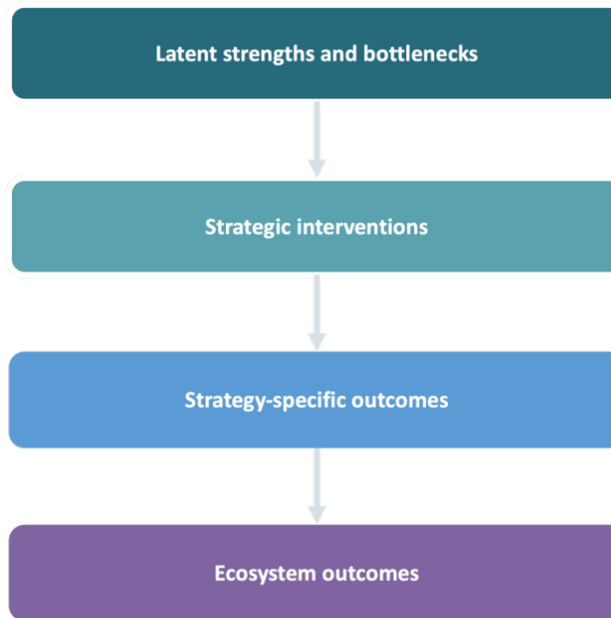
3.3.1 Place-based innovation policy

The place-based approach has diffused and been adapted to other policy domains, not least innovation policy. Place-based innovation policy represents a paradigm shift away from distributive approaches compensating for locational disadvantages of less developed regions to an approach intended to enhance regional competitiveness by tapping underutilised potential (OECD, 2009b). This is achieved by fostering innovation in specific regions through participative and deliberative decision-making processes which mitigate underdevelopment traps (Barca, McCann and Rodríguez-Pose, 2012).

The European Union's National/Regional Research and Innovation Strategies for Smart Specialisation (RIS3) programme represents the most comprehensive approach to place-based innovation policy. A key component of RIS3 is the Entrepreneurial Discovery Process (EDP), a public-private, multi-stakeholder collaborative co-creation process intended to generate knowledge about the future economic value of possible transformation of existing sectors (known as 'related variety') or establishment of new sectors in a region (Foray, 2014, 2017; McCann and Ortega-Argilés, 2016). The focus is on cross-sector and cross-technology developmental projects, while sectoral level specialisation or 'picking winners' is avoided. The most promising options are incorporated within shared regional development agendas intended to support a structural evolution of the whole regional economy. In practice, many RIS3 agendas have been based on a set of specialisation domains defined under the EDP (Esparza Masana and Fernández, 2019).

In the US, there has been a recent resurgence of interest in place-based innovation policy instruments intended to unlock latent economic potential and stimulate growth in lagging regions (Gansauer, 2024). These include the Regional Innovation Engines programme, the aim of which is to support the establishment of multiple flourishing regional innovation ecosystems across the US (NSF, 2024). The programme is designed to facilitate behavioural changes that 'rewire' existing innovation ecosystems, such as removing bottlenecks, leveraging under-tapped latent capability, or introducing a new capacity to address ecosystem weaknesses (Guzman et al., 2023). This is to be achieved through stakeholder engagement, holistic ecosystem assessment, and implementable strategic choice (Figure 7). The aim is to achieve modest but real improvements in the conditions supporting the ecosystem which have the potential to offer an outsized impact in terms of social returns.

Figure 7 | Regional innovation engines logic model



(Source: adapted from Guzman et al., 2023)

Other examples of place-based innovation policy include the siting of large-scale research infrastructures which can have very long-term impacts on economic geography, the presence of applied research institutes which can have a positive impact in lagging regions, and the use of regional R&D subsidies which can increase innovation in already innovative regions (Lee, 2024).

There are a number of limitations associated with place-based innovation policy (Kitson, 2019; Lee, 2024). The approach can be too narrow for the requirements of many places, particularly where the focus is on innovation production rather than diffusion and absorption, and because innovation-producing sectors are relatively small and contribute little to most local economies. The interdependency between drivers of regional competitiveness means that investment in innovation must be accompanied by investment in complementary assets. Regions competing to develop agglomeration economies may simply move firms from one region to another, dispersing assets and capabilities which weakens national innovation capabilities. RIS3 approaches may increase inequality between highly developed regions, and participating regions often concentrate on fashionable rather than locally embedded sectors.

3.3.2 Mission-oriented and place-based innovation policy

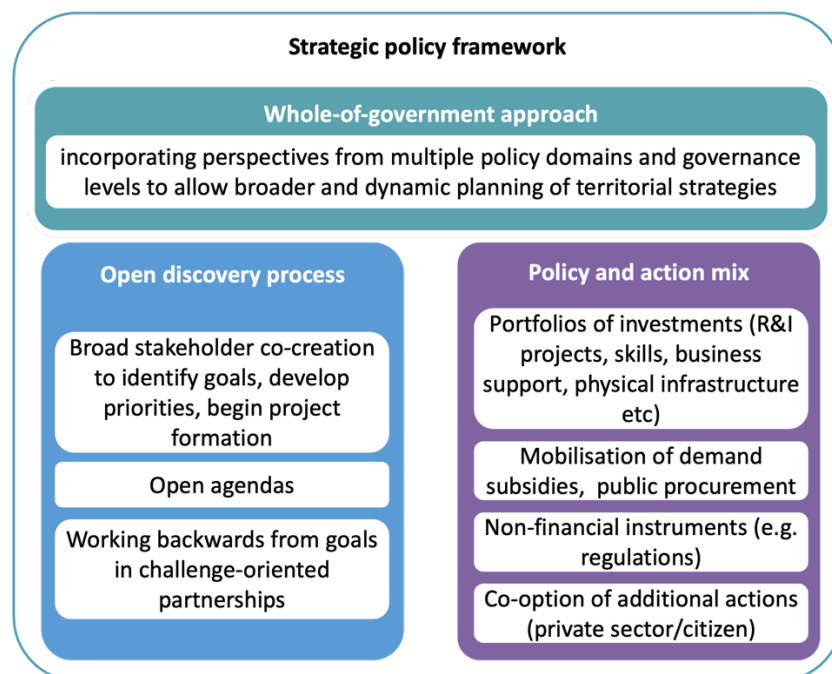
Progressive growth theories and the ‘Transformative innovation’ policy framing have become increasingly influential in policy thinking in recent years, not least in the spread of mission-oriented innovation policy (Mazzucato, 2017). Missions have typically been framed as spatially blind endeavours, disconnected from geographies of innovation and the socio-spatial contexts in which they unfold (Uyarra et al., 2025). However, regional innovation policy is increasingly seen as an important aspect of the mission-oriented approach, intensifying focus on questions of directionality (what futures are socially desirable), societal and democratic legitimacy (who defines these futures), and responsibility (transformation by and for whom) (Uyarra, Ribeiro and Dale-Clough, 2019).

The emergence of the transformative innovation framing has seen a critical reappraisal of the regional innovation system approach and the development of ‘challenge-oriented regional innovation systems’ (CORIS) (Tödtling, Tripl and Desch, 2022). This emphasises the coordination of a broader set of innovation actors at different territorial scales, aligned with a collectively agreed directionality of change to address societal challenges, and with a greater focus on innovation application and upscaling. The relevant innovation system is not given ex ante but emerges around challenges through collaboration and negotiation – i.e. it may or may not include local universities and corporations which make up existing innovation systems (Wanzenböck and Frenken, 2020). Challenges are addressed through experimentation, coordinated through experimental and reflexive multi-level governance arrangements that coordinate action and diffuse and scale successes through collective learning, enabled by real-time monitoring and evaluation.

There are also a number of limitations associated with the ability of transformative and mission-oriented R&I policy to tackle societal challenges. These include an optimistic view of top-down governance, possible unintended consequences of picking winners, and levels of acceptance of real-time monitoring and evaluation techniques (Laatsit, Grillitsch and Fünfschilling, 2025).

In the EU, incorporation of the European Green Deal (EDG) as part of the European Commission’s long term policy agenda in 2019 saw sustainable growth being prioritised over inclusive and sustainable growth for the first time. A new regional innovation policy approach was developed to deliver the EDG, named ‘place-based innovation policy for sustainability’ (RIS4) (McCann and Soete, 2020; Serger, Soete and Stierna, 2023). This integrates a mission-oriented approach with RIS3 to enable the bottom-up design and implementation of possible sustainable development paths aligned with the directionality set out in the EDG (Miedzinski et al., 2022). The approach has been operationalised in the Partnerships for Regional Innovation (PRI) and subsequent Innovation for Place-based Transformations (IPbT). PRI comprises three building blocks, a strategic policy framework, an Open Discovery Process broader than RIS3’s EDP, and a policy and action mix (Figure 8) (Pontikakis et al., 2022a, 2022b).

Figure 8 | Partnerships for Regional Innovation building blocks



(Source: adapted from Pontikakis et al., 2022a)

In the US, 'Bidenomics' represents a mission-oriented, place-based approach to grow a greener, fairer economy, address social inequalities, and develop strategic industries to maintain national competitiveness (Gansauer and Westwood, 2024). It includes a policy mix of regional investments which prioritise the following (Gansauer, 2024):

- National economic competitiveness and resilience (e.g. Regional Direct Air Capture Hubs, Regional Clean Hydrogen Hubs, Regional Technology and Innovation Hubs)
- Unlocking latent economic potential and stimulating growth in lagging regions (e.g. Regional Innovation Engines and the Build Back Better Regional Challenge)
- Building foundational capacities and assets in regions as indirect baselines for future growth (e.g. Statewide Planning, Research Networks Program, ARPA Indigenous Communities Program)
- Reversing geographically uneven histories of under- and disinvestment through direct federal reinvestment without a specific growth imperative (e.g. Rebuilding American Infrastructure with Sustainability and Equity ('RAISE') program).

In the UK, the current government's 'securonomics' agenda is a mission-oriented, place-sensitive approach which positions as its primary mission the unleashing of the full potential of UK cities and regions by enabling existing services and manufacturing sectors to adapt and grow while seizing opportunities to lead in new and emerging sectors (HM Government, 2024a). This approach is influenced by modern supply-side economics (Section 2.2.12), as well as concepts including the foundational economy, community wealth building, and the wellbeing economy (Crisp et al., 2024; Deas, Haughton and Ward, 2021; Reeves, 2023; Thompson et al., 2020).



**A strategic approach to
regionally focused R&I
policy**

4 A strategic approach to regionally focused R&I policy

Significant experience has now been gained in the design and implementation of place-based R&I policy, and new thinking is currently emerging to shape the design and implementation of policies to deliver the Bidenomics and European Green Deal agendas. To assist policymakers in thinking through challenges and opportunities in this area, this chapter draws on this knowledge to develop a strategic approach to regionally focused R&I policy.

Insights are drawn from a number of established and emerging regionally focused development and R&I policy instruments, including the EU’s European Regional Development Fund, Smart specialisation and Innovation for Place-based Transformation, the US Regional innovation Engines, and the UK Strength in Places Fund (Table 3).

Table 3 | Selected regionally focused policy instruments

Instrument	Jurisdiction	Objective
European Regional Development Fund (ERDF)	EU	Strengthen economic, social and territorial cohesion in the EU by correcting imbalances between its regions
National/Regional Research and Innovation Strategies for Smart Specialisation (RIS3) ¹	EU	Foster knowledge-based growth in EU regions and countries, crucial to achieving a smarter, sustainable and inclusive Europe
Innovation for Place-based Transformation (IPbT), incl. Partnerships for Regional Innovation (PRI) ¹	EU	Raise awareness and enhance understanding of transformative innovation policies Enhance the readiness of territories to implement transformative innovation policies through the development of new capacities Experiment using participatory and innovative approaches to meet complex sustainability transition challenges Inform the debate on an EU Policy framework fit for the future beyond 2027
Regional Innovation Engines programme (RIE)	US	Establish multiple flourishing regional innovation ecosystems across the US, spurring economic growth in regions that have not fully participated in the technology boom of the past few decades
Strength in Places Fund (SIPF)	UK	Support innovation-led relative regional growth by identifying and supporting areas of R&D strengths that are driving clusters of businesses with potential to innovate, or to adapt to new technologies in order to become nationally and internationally competitive Enhance local collaborations involving R&I, knowledge institutions, and engage businesses at the forefront of delivering economic growth through innovation within the identified economic geography

¹ Funded through ERDF

By ‘strategic approach’, we mean an approach to strategising by public sector organisations that is traditionally understood as integrating two stages of a strategy process: the formulation of strategic plans and the implementation of those plans (Bryson and George, 2020). This can help public organisations achieve important goals and create public value.

As well as exploring how strategic formulation and implementation are being operationalised in contemporary regionally focused R&I policy, we also discuss how the integration of transformative innovation policy and place-based R&I policy approaches necessitates the introduction of a new stage of the public sector strategy process. This is called ‘policy orientation’, referring to the identification of areas for preferential interventions intended to effect change aligned with collectively agreed directionalities.

In addition, we discuss capacity development, regarded as an important first step for regionally focused R&I policy formulation and implementation. We highlight emerging evidence that traditional approaches to capacity development may be insufficient to enable public sector organisations to successfully design and implement mission-oriented innovation policies.

4.1 Institutional capacity development

Institutional capacities are essential for the design and implementation of place-based R&I policies. These capacities can be held by individual organisations (organisational capacities), but also as networking capacities enabling horizontal and vertical coordination between organisations and levels of government (Serger, Soete and Stierna, 2023). Specific capacities include strategy design, monitoring and evaluation, policy co-creation, foresighting, as well as financial and technical implementation capacities.

Institutional capacity gaps are not uncommon, and an established principle of place-based policy is that it should begin with a concerted effort to develop capacities at all levels of government, and particularly the subnational level (OECD, 2018). This can be achieved via a ‘learning-by-doing’ process in which national and subnational stakeholders learn through repeated interactions with each other.

However, emerging evidence suggests that learning-by-doing may not be sufficient for delivery of mission-oriented innovation policy in context, and that certain prerequisites must be present for capacity-building efforts to be successful in this area. These include the availability of a critical mass of motivated and talented people, high-level political support and legitimisation, and internal dissatisfaction with existing working arrangements (Kattel, 2022).

To understand why this is so, it is necessary to identify the types of capacities and capabilities public sector organisations need to design and implement mission-oriented innovation policy. Missions require public sector organisations to collectively possess capacities and capabilities for ‘agile stability’, enabling them to unleash innovations while simultaneously maintaining socio-political stability (Kattel, Drechsler and Karo, 2019). These include specific capacities/capabilities enabling navigation and dynamic portfolio management, connecting and coordination, and learning and reflexivity (McLaren and Kattel, 2025). However, these transformative roles conflict with dominant traditions of public administration, making public sector organisations reluctant to undertake them (Braams et al., 2022). In the absence of these capacities/capabilities, missions underperform because they are constrained to business-as-usual practices and incremental changes in working methods (Kattel and Mazzucato, 2023).

4.2 Policy orientation

Policy orientation refers to the identification of areas for preferential interventions intended to effect change aligned with collectively agreed directionalities (Foray, 2019; Kroll, 2019).

Regionally focused R&I policy instruments founded upon a ‘Systems of innovation’ framing are intended to enhance the ‘health’ of innovation systems and strengthen innovation capabilities, but not to shape innovation direction and trajectories towards socially desirable objectives (Daimer, Hufnagl and Warnke, 2012). While these instruments can have orientations, these tend to be implicit and general (e.g. ‘increase growth’), and markets are seen as the main system coordination mechanism (Tödtling, Trippl and Desch, 2022).

Because growth is now recognised to have multiple alternative directions (e.g. smart, inclusive and sustainable growth), the inability of regionally focused R&I policy to shape innovation direction is increasingly seen as problematic (Kattel and Mazzucato, 2018). This directionality failure justifies a strategic agenda setting role for governments in specifying the overall direction of, and objectives for, change in areas such as grand challenges, developing national strategic technology capacities, or radically transforming traditional and mature industries (Foray, 2019; Kroll, 2019).

For public sector organisations, the directionality failure surfaces where agenda-setting is not sufficiently operationalised within policy design. This may include a lack of shared visions, gaps in collective coordination for shaping systemic change, insufficient regulation or standards to guide change, and a lack of targeted funding for R&D and demonstration projects and infrastructures to accelerate innovation along specific trajectories (Weber and Rohracher, 2012).

Addressing this failure requires the addition of a new stage – ‘policy orientation’ – to the traditional two stage public sector strategic management process of policy formulation and implementation (Figure 9). Policy orientation encompasses the identification of areas for preferential interventions intended to effect change aligned with collectively agreed directionalities (Kroll, 2019).

Figure 9| Public sector strategic management process



(Source: adapted from Kroll, 2019)

IPbT has operationalised this strategic orientation stage through the use of a mission-oriented innovation policy roadmapping framework to give a long-term orientation to policy formulation and implementation (Bianchi et al., 2024a; Miedzinski, Mazzucato and Ekins, 2019). This breaks down overarching grand challenges into missions intended to stimulate cross-sectoral R&I and behavioural change, and further into a portfolio of bottom-up experiments (Figure 10). Other approaches, such as forecasts, adaptive pathways, and scenario planning may also be used, depending on levels of uncertainty and agency associated with a given context (Sharpe et al., 2016).

4.3 Policy formulation

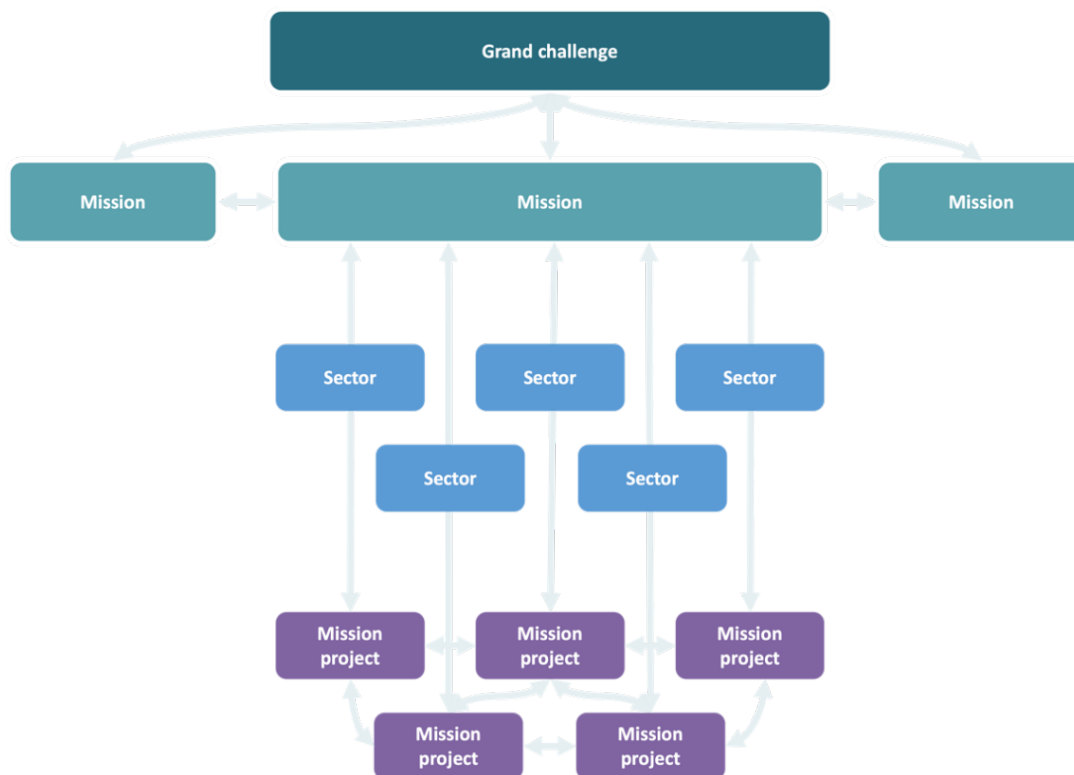
Policy formulation and planning includes activities such as mandate analysis, definition of mission and values, analysis of the internal and external environments, identification of strategic issues, formulation of strategies to address issues, and articulating a future vision (Bryson and George, 2020). Below, we highlight activities of specific relevance to regionally focused R&I policy formulation.

4.3.1 Choosing unit of intervention: regional administrative unit or functional economic area

Historically, regional policy focused on the region as its unit of intervention. In addition to being a level of geography at which innovation is produced and economic performance measured, regions are also an administrative unit and a level of economic governance set between the national and cluster or organisational levels (Asheim and Gertler, 2009).

This focus has seen the emergence of a range of classification systems to categorise and differentiate between regions. Population-based classifications include OECD’s Territorial Levels (TL) which distinguish at a subnational level between large TL2 regions (e.g. East of England) composed of smaller TL3 regions (e.g. Suffolk) (OECD, 2022). The EU’s Nomenclature of Territorial Units (NUTS) divides Member states into four subnational levels of descending population (level 1: major socio-economic regions; level 2: basic regions; level 3: small regions comprised of Local Administrative Units (LAU) (Eurostat, 2019, 2023). The UK’s International Territorial Levels (ITLs) typology replaced NUTS in 2021, though currently mirror the NUTS structure (ONS, 2021) (Table 4).

Figure 10| Mission-oriented innovation policy roadmapping framework



(Source: adapted from Miedzinski, Mazzucato and Ekins, 2019)

Table 4 | UK International Territorial Levels

	ITL1	ITL2	ITL3	LAU
England	Statistical regions	Counties/groups of counties	Counties, unitary authorities, local authority districts, some grouped	Local authority districts
Scotland	Scotland	Combinations of council areas	Combinations of council areas	Combinations of council areas
Wales	Wales	Groups of unitary authorities	Groups of unitary authorities	Unitary authorities
Northern Ireland	Northern Ireland	Northern Ireland	Local government districts	Local government districts
Total in UK	12	41	179	-

(Source: adapted from ONS, 2021)

Classifications which nuance population types are also used, including OECD's extension of TL3 regions to account for predominantly urban, predominantly rural or intermediate populations (Brezzi, Dijkstra and Ruiz, 2011).

Table 5 | Selected regional differentiation typologies

Dimension	Types
Productivity (OECD)	<p>Frontier – the region leading its country in terms of labour productivity, measured by the real gross domestic product per employee</p> <p>Catching-up – regions where labour productivity grew by at least 5 percentage points more than the frontier based on data between 2000 and 2013 (or closest year available)</p> <p>Diverging – regions where labour productivity dropped by at least 5 percentage points less than the frontier</p> <p>Keeping-pace – regions falling within the +/- 5 percentage points band</p>
GDP (EU)	<p>Less developed regions – GDP per capita < 75 % of the EU average</p> <p>Transition regions – GDP per capita is between 75 % and 90 % (2014-2020) or 75 % and 100 % (2021-2027) of the EU average.</p> <p>More developed regions – GDP per capita > 90 % (2014-2020) or 100 % (2021-2027) of the EU average</p>
Competitiveness (EU)	<p>Stage 1 – GDP index <75% of EU-27 average (Weighting: Basic – 30%; Efficiency – 50%; Innovation – 20%)</p> <p>Stage 2 – GDP index 75-100% (Weighting: Basic – 25%; Efficiency – 50%; Innovation – 25%)</p> <p>Stage 3 – GDP index > 100% (Weighting: Basic – 20%; Efficiency – 50%; Innovation – 30%)</p>
Regional innovation system deficiencies	<p>Peripheral regions – Weakly developed, lacking dynamic clusters and support organisations ('organisational thinness')</p> <p>Old industrial regions – Too strong clustering, overspecialised in mature industries experiencing decline ('lock-in')</p> <p>Fragmented metropolitan regions – lacking dynamic clusters of innovative firms; many high quality but often weak industry links ('fragmentation')</p>

Classification systems based upon measures other than total population can be used (Table 5). The OECD classifies regions into four levels of productivity (Frontier, Catching-up, Diverging, Keeping-pace) (OECD, 2016). The EU uses a GDP-based typology to classify regions as less developed, transition, and more developed (ECA, 2019). Transition regions refer to middle-income regions that experience development traps – i.e. lengthy periods of low growth, weak productivity increases, low

job creation, or employment loss – as a consequence of persistent structural challenges (Diemer et al., 2022). This sees them being progressively caught up by less prosperous but fast developing regions while still being outdistanced by the more developed regions. Categorisations based on regional competitiveness have been developed in both the EU and UK (Dijkstra et al., 2023; Huggins, 2003).

Regions can also be differentiated in terms of deficiencies in their regional innovation systems (Peripheral regions; Old industrial regions; Fragmented metropolitan regions) (Martin and Trippl, 2014; Tödtling and Trippl, 2005). This approach offers the advantage of being able to inform regional strategies for industrial path development, involving transformation of technological trajectories. Industrial path development strategies can include (Foray, David and Hall, 2011; Grillitsch and Asheim, 2018; Lester, 2005; Oinas and Malecki, 2002):

- **Transition** from an old, declining activity to a new one through discovering that a new domain can emerge from existing regional industrial capabilities
- **Upgrading** e.g. climbing hierarchies in global production networks; renewal based on new technologies/business models; strategic niche management
- **Modernisation** through discovering that the development of specific applications of a general purpose technology can have a significant impact in terms of efficiency and quality in an existing (perhaps traditional) sector
- **Regional diversification** through the discovery of potential synergies (e.g. economies of scope, spillovers) likely to materialise between an existing and well-established economic activity and another under-developed activity, resulting in the development of a new line of productive activity
- **Radical formation** through the discovery that R&D and innovation in a certain field has the potential to create activities that will be progressive and commercially attractive within the content of the regional economy, whereas previously they were not so, resulting in the development of an entirely new and distinct domain of enterprise.

Within the place-based approach to development policy, the administrative boundaries that delineate regions are often not emphasised. The focus is on the ‘place’, defined as ‘a contiguous/continuous area within whose boundaries a set of conditions conducive to development apply more than they do across boundaries (i.e. relative to other places): natural and cultural circumstances and the preferences of people are more homogeneous or complementary, the knowledge of people is more synergetic, and positive externalities and formal and informal institutions are more likely to arise’ (Barca, McCann and Rodríguez-Pose, 2012).

Given this definition of place, it makes sense to implement place-based policies at the level of the functional economic area (FEA) rather than the region (McCann and Ortega-Argilés, 2016). FEAs are territorial categorisations according to functional relations (e.g. labour markets, current and potential commuting area, journeys to services). They are preferred because they enable capture of spillovers and avoid administrative gaps which may see different jurisdictions not benefitting from economies of scale.

Functional urban areas represent a specific type of FEA, intended to capture meaningful connections between cities and their surrounding areas (Dijkstra, Poelman and Veneri, 2019; Fadic et al., 2019).

In the UK, FEAs are increasingly emphasised as an important administrative unit for regional growth (British Academy, 2024). The English Devolution white paper sets out a goal of establishing universal

coverage of Strategic Authorities in England, providing a governance and coordination structure which enables core growth levers to be devolved and aligned with FEAs (HM Government, 2024b).

4.3.2 Choosing spatial arrangements

Different spatial arrangements can be chosen as the focus of place-based R&I policy, such as mega-urban regions, regions with intermediate and smaller cities, predominantly rural regions. All can all make substantial contributions to economic growth through achieving high levels of productivity in the activities in which they are best-suited (OECD, 2011a, 2011b).

However, territories (supra)national spatial strategies can prioritise different spatial arrangements linked with an overall place-based or place-sensitive approach. The US Bidenomics agenda's place-based approach prioritised heartland cities in lagging regions on the principle of 'latent capacity' (Gruber, Johnson and Moretti, 2022; Gruber and Johnson, 2019). This centres on the idea that higher socioeconomic return on investments may be achieved by upgrading and rewiring innovation ecosystems already present in a large number of mid-size cities to enhance innovative productivity, rather than focussing on top-tier innovation ecosystems in a few large cities (Guzman et al., 2023). Regions without competitive advantages and distressed regions did not significantly benefit (Gansauer and Westwood, 2024).

With parallels to Bidenomics, the UK's industrial strategy green paper outlines a place-sensitive approach with a concentration of efforts on city regions, clusters, and strategic industrial sites with the greatest growth potential within eight 'high growth' sectors (HM Government, 2024a).² In support of this type of approach, evidence suggests that prioritising increased R&D funding in regions with historically lower levels of public R&D outside the Greater Southeast yields larger returns than space-blind allocation patterns in terms of regional output, employment and gross value added (GVA) (Ma, Ortega-Argilés and Lyons, 2024).

In the EU, the Partnerships for Regional Innovation pilot programme has been rolled out across multiple regions, cities and networks of regions and cities (Bianchi et al., 2024b). More broadly, while EU cohesion policy prioritises less developed regions, transition and more developed regions are also supported to enable uniform implementation of overarching policy goals (Suedekum, 2023). This may change as competitiveness and security become increasingly important in the EU's policy agenda (Draghi, 2024; Letta, 2024).

4.3.3 Choosing resource allocation logics: neutral or non-neutral

R&I policies following a 'neutral' logic of resource allocation do not prioritise specific domains, technologies, or sectors. However, where the policy objective is not merely to incentivise innovation in general, but to address the rate of innovation in certain prioritised directions where it is insufficient, the neutral logic is insufficient. This would apply in the cases of tackling grand challenges, developing national strategic technology capacities, or radically transforming traditional and mature industries. Here, a 'non-neutral' logic can be used to support preferential interventions in one or more of these areas (Foray, 2019).

² The UK's eight high growth sectors are advanced manufacturing, clean energy industries, creative industries, defence, digital and technologies, financial services, life sciences, and professional and business services.

Preferential interventions have been criticised on a number of grounds. They may introduce market distortions, there may be insufficient government capacities to fix sector- or technology-specific coordination failures, increased R&D spending alone can be too narrow to effect system change, and there is a risk that top-down ‘picking winners’ may limit bottom up information flows. (Foray, 2019).

New principles for preferential interventions have been developed to minimise these four problems (Foray, 2019). First, specialised human capital development should precede increasing R&D spending in the domain. Second, a vision of the transformative activity should be developed, covering technology diffusion and adoption as well as technology development. Third, a mix of instruments should be deployed, sufficient to address the market failures present. Fourth, an experimental approach is required to identify what works, because the inherent uncertainty of innovation means that principal-agent governance arrangements of the ‘neutral’ logic will be insufficient. Fifth, policy design should be an intermediate process aimed at enhancing bottom-up entrepreneurial coordination within a top-down framework of priority areas structured by the government.

4.3.4 Choosing funding allocation methodology: formula-based or competitive allocation

A number of funding allocation methodological options exist in the UK which could be suitable to support higher education providers (HEPs) to engage in regionally focused R&I (Research England, 2022). These include funding for specific national facilities and initiatives located in a specific region, formula-based funding to support sustainable investment in facilities, infrastructure, and knowledge exchange activities, and competitively allocated project-based funding.

In selecting a methodology, a trade-off arises between policy efficiency and local flexibility. The place-based approach recognises that knowledge needed to fully exploit a place’s growth potential is not readily available and needs to be newly produced (McCann, n.d.; OECD, 2018). This requires flexibility to pursue local opportunities identified through participatory and deliberative processes. However, policy efficiency considerations may prioritise rapid use of available resources and minimal administrative costs.

Formula-based and competitive funding allocations differ in terms of the efficiency and flexibility offered. Formula-based allocations offer stability and greater certainty for recipients through more predictable annual allocations, enabling long-term planning (Debackere et al., 2018). They also offer low administrative costs, minimal risk of government failures, and the potential to adjust formulae over time. Unhypothecated formula funding offers flexibility, but there is a potential for policy capture by powerful local actors (Laranja and Reimeris, 2024). Competitive allocations enable the assessment of a broader range of qualitative and quantitative information through peer- or expert review panels. This can make allocations more representative and is useful in assessing unique regional contexts and place-based development strategies. It also enables ex ante evaluation to inform policy design and formative evaluation to inform policy implementation. However, competitive allocations introduce greater administrative costs and potential conflicts of interest (Debackere et al., 2018).

A combination of the two approaches can be useful, as illustrated in the allocation of the ERDF (Figure 11). The formula-based Berlin method is used to allocate ERDF funding to Member states based on regional socioeconomic data collected by Eurostat (ECA, 2019). Criteria having the largest effect on allocations are relative regional prosperity and unemployment rates (Table 6).

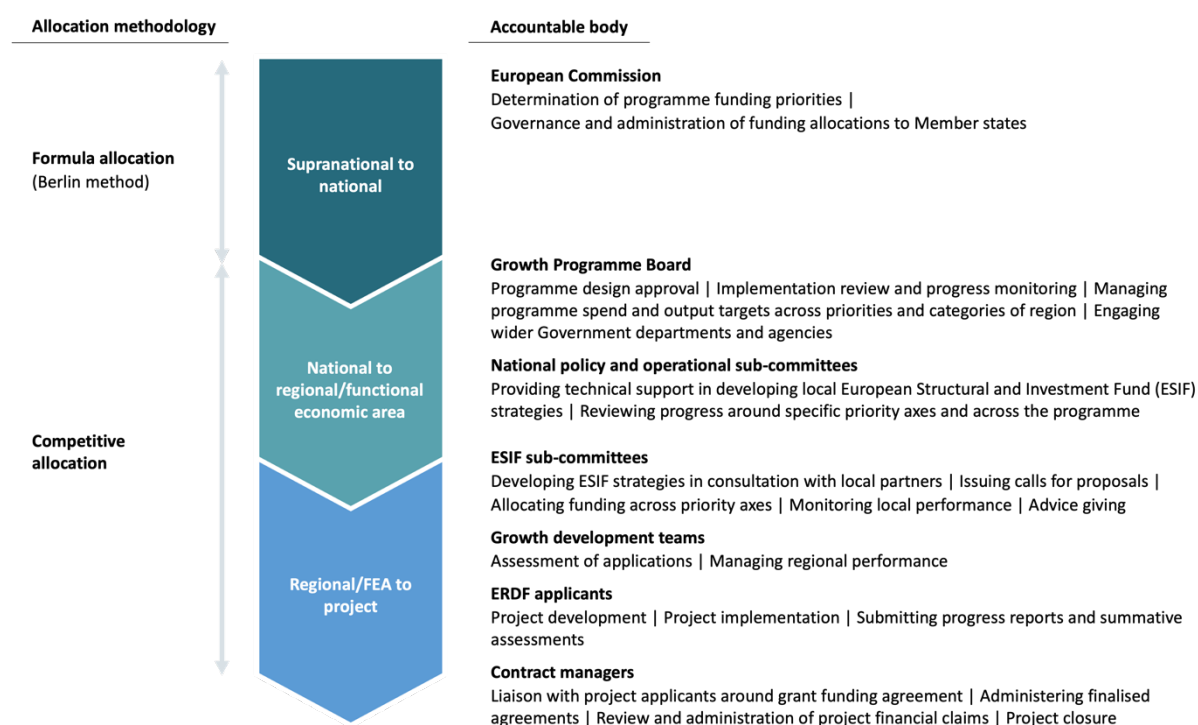
Table 6 | ERDF financial weights of allocation criteria

Criterion	2014-2020 (%)	2020-2027 (%)
Prosperity (measured as both GDP and GNI)	86	81
Labour market, education, demographics	14	15
Climate	-	1
Migration	-	3
Total	100	100

(Source: European Commission, 2014, p.198).

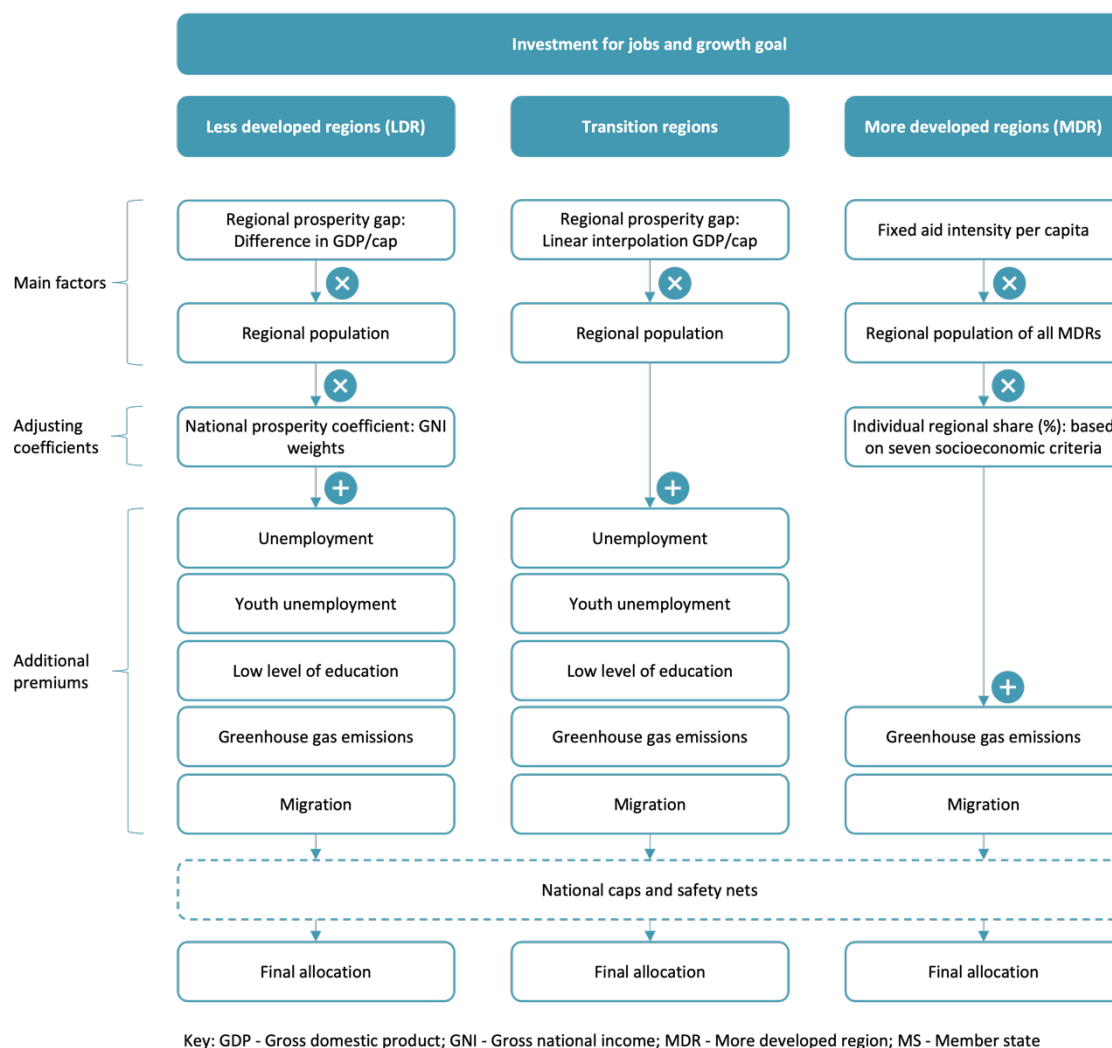
The formula adjusts to account for differentiation between less developed, more developed, and transition regions (Figure 12). Once allocations are made to Member states, funding is then distributed to regional/FEA and project levels through a competitive application process. The development of RIS3 regional innovation strategies serves as a prerequisite for the award of regional-level ERDF allocations.

Figure 11 | ERDF allocation methodology



(Source: MHCLG, 2019, authors' interpretation)

Figure 12| ERDF allocation framework (2021-2027)



(Source: Adapted from ECA, 2019)

4.3.5 Participative, deliberative and discovery processes

The assumption that similar policies will have a similar impact in different places – known as ‘universal’ policy design – is a recognised issue in place-based innovation policy (Kitson, 2019). In practice, variations in regional industrial structure, institutional and absorptive capacities, local universities etc. can all have a major influence on policy impact.

‘One-size-fits-all’ policy designs led by central government should be avoided in regional development policy (OECD, 2009a, 2009b; Rodrik, 2005). Instead, policy instruments should be designed to reflect territorial specificities and be adapted to regional contexts (OECD, 2018).

In the place-based approach, the engagement of local stakeholders and actors is regarded as being central to the effectiveness of regional development policy and R&I policy (Barca, McCann and Rodríguez-Pose, 2012; McCann and Ortega-Argilés, 2016). This can be done through participatory and deliberative processes involving all relevant stakeholders to reflect territorial capabilities, specificities and contexts, coordinating with external agencies through multilevel governance processes.

One important participatory and deliberative process for regionally focused R&I policy is ‘discovery’. Discovery recognises that policy outcomes are unknowable *ex ante* and instead emphasises getting the policy process right to design a setting that enables strategic collaborations between different actors to discover the obstacles to regional economic restructuring and how to remove them (Rodrik, 2004). It underpins a range of policy approaches, such as ‘New Industrial Policy’ (Rodrik, 2004), mission-oriented innovation (Mazzucato, 2018), and transformative innovation (Schot and Steinmueller, 2018).

Discovery has been operationalised in the RIS3 Entrepreneurial Discovery Process which engages stakeholders from business, academia, government and civil society in an inclusive, evidence-based process to define and prioritise R&I specialisation domains, and develop shared agendas for their development (Esparza-Masana, 2022; Gianelle et al., 2016; Laranja, 2022; Laranja, Perianez-Forte and Reimeris, 2022; Santini et al., 2016). The IPbT Open Discovery Process is more broadly participative, engaging actors typically excluded from innovation activities (Fernández et al., 2023; Laranja and Reimeris, 2024).

4.3.6 Strategic intelligence

Strategic intelligence (SI) refers to the systematic collection, evaluation, and application of information to support evidence-based decision-making and long-term planning in policy. SI has evolved over time, from the use of evaluation, technology foresight, and technology assessment, to enhanced tools and distributed intelligence, to the integration of artificial intelligence (Edler and Walz, 2024; Kuhlmann et al., 1999).

One approach which has been incorporated into the operationalisation of the RIS3 process is regional competitive intelligence (Doussineau, Saublens and Harrap, 2021). This is a benchmarking process whereby regional ecosystem stakeholders (e.g. firms, academic institutions, regional government) engage in measurement of the performance, processes and policies of competitors to assess stakeholder needs and enable learning by comparing (Huggins, 2010).

Strategic foresight is a method used to create functional and operational views of possible futures and the possibilities that exist within them with a view towards influencing today’s decisions (Tönurist and Hanson, 2020). Foresight is increasingly integrated into anticipatory and proactive governance arrangements (Monteiro and Dal Borgo, 2023). For example, IPbT employs foresight to help frame challenges to be tackled, and combines it with a range of complimentary approaches (e.g. vision diagnosis and development, development of transition pathways and roadmaps, selection of milestones and targets) in an overall approach to enable envisioning (Bianchi et al., 2024b).

More recently, the use of complexity and relatedness measures as an input to inform regionally focused R&I policy design has been emphasised (Benoit et al., 2025). Complexity measures offer a perspective of an economy’s capacity to produce a diverse range of sophisticated technologies emphasising both technological variety and rarity in the global landscape. Relatedness measures the degree of similarity between different economic activities based on the shared knowledge and competencies required for their production. Collectively, these measures provide a framework for understanding the unique strengths of an economy’s existing knowledge base and can be used to highlight opportunities for diversification and future growth.

4.3.7 Building legitimacy

Building legitimacy can be important within place-based innovation for sustainability to achieve and maintain agreement on the development of transformation goals and vision, manage cooperation, and justify actions and the use of public funds.

Legitimacy-building measures emphasised within the IPbT programme include the establishment of formal mandates for change, supporting scientists who provide impartial evidence, tackling misleading narratives, encouraging public engagement and participation, and development of a strategic intelligence system to develop evidence-based rationales for transformative visions and action (Bianchi et al., 2024b).

4.3.8 Multilevel governance

Within regionally focused R&I policy, a directionality-subsidiarity tension can arise between the need for top-down orientation of subnational activities to address national priorities (and supranational priorities, in the case of the EU) versus the need to empower subnational stakeholders to enable bottom-up contributions to the design and implementation of regional growth strategies (Serger, Soete and Stierna, 2023).

This tension can be addressed through multilevel governance (MLG) arrangements which distribute decision-making authority and responsibility between multiple levels and types of governmental, quasi-governmental, and non-governmental groups (Hooghe and Marks, 2003). Within MLG, governance is seen both as an instrument to ensure efficient delivery of public goods and as a means to satisfy different communities' desire for self-rule (Hooghe, Marks and Schakel, 2023).

Participatory MLG is seen as crucial for the design and implementation of RIS3 strategies, although this is not without challenges (Doussineau, Saublens and Harrap, 2021; Guzzo and Gianelle, 2021; Kristensen, Pugh and Grillitsch, 2023). Governance challenges associated with mission-oriented policy are likely to be even greater, so consideration should be given to the suitability of different types of MLG to the orientation approach taken (Table 7) (Uyarra, 2024).

A 'whole-of-government' governance approach has recently been established in the EU to ensure horizontal and vertical coordination in transformative R&I policy, engage stakeholders, and identify synergies in cross-cutting objectives (Polt, 2024).

In the UK, the English Devolution white paper described plans to establish MLG arrangements, convening different levels of government within a Council of the Nations and Regions, Mayoral Council, and local authorities Leaders Council (HM Government, 2024b). Specific governance arrangements for the emerging mission-oriented, place-sensitive (securonomics) approach to government have not been announced as yet.

Table 7 | Selected benefits and challenges of multi-level governance approaches

Approach	Suitable for	Benefits	Challenges
Meta-governance	Overarching mission-oriented strategic frameworks	Enables central oversight, policy coordination and coherence across sectors and levels of governance	Risks over-management, blurred accountability, high coordination costs, stifling of bottom-up innovation
Network governance	Challenge-based programmes and schemes	Enables coordinated action across boundaries and organisations	Consensus risks suboptimal decisions Potential for exclusion of weaker groups
Adaptive governance	Ecosystem-based mission programmes	Allows incremental responses to emergent issues in complex environments Promotes learning through experimentation	Risks uncoordinated responses Time-consuming participation processes
Experimental governance	Place based missions	Fosters localised innovation and problem-solving adapted to context and place	Can reduce coherence Less developed or peripheral areas may have less ability to engage in experimentation effectively Administration incompatible with conventional public policy accountability rules, requires a Schumpeterian development agency ¹

¹ (Radosevic, Kanellou and Tsekouras, 2023)

4.3.9 Vertical and horizontal coordination

MLG arrangements should be designed to enhance vertical coordination (i.e. different geographical levels of government and between ministries and sub-ordinate agencies) and horizontal coordination (i.e. across policy domains) (Weber and Rohrer, 2012).

Vertical coordination can be enhanced through a blend of top-down directionality and bottom-up deliberation and autonomy (Serger, Soete and Stierna, 2023; Wanzenböck and Frenken, 2020). For example, ERDF defines a set of thematic objectives and priority axes, offering a menu of options from which subnational actors select those that resonate most with their unique circumstances (McCann and Ortega-Argilés, 2013) (Table 8).

Conditionalities can be used to encourage mutual accountability and alignment between local/regional and (supra)national levels. These are binding agreements that govern principles underpinning relationships between local stakeholders and different levels of governance (Barca, 2009; Barca, McCann and Rodríguez-Pose, 2012; Berkowitz, Rubianes and Pieńkowski, 2017; Mizell, 2017; Molica, 2024; Shah, 2017). Public support is provided in return for the recipients undertaking specific actions, e.g. guaranteeing equitable and affordable access to innovative products and services, risk/reward sharing, reinvestment, and pursuing activities aligned with sustainable development goals (Mazzucato and Rodrik, 2023).

Local ownership of (supra)national policy goals can evolve over time and through constant interaction between (supra)national and subnational governments during policy implementation (OECD, 2018). Greater simplicity, flexibility, and trust-based relationships also help create a feeling of ownership.

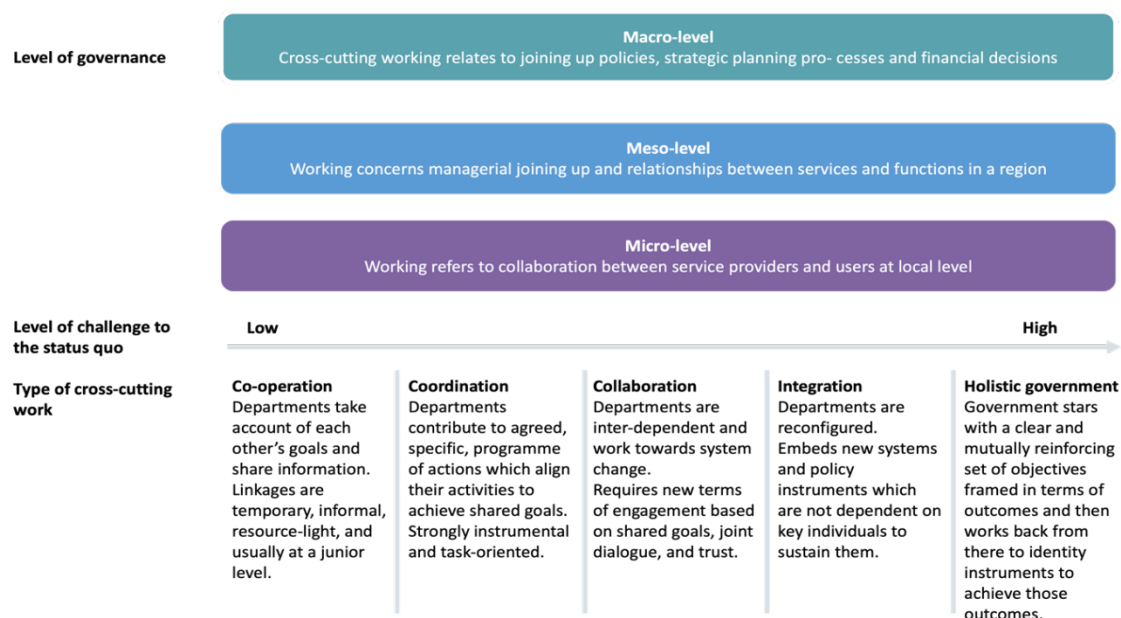
Table 8 | 2014-20 English ERDF Operational Programme: Thematic objectives, priority axes, and notional allocations

Thematic objective (TO)	Priority axis (PA)	Notional allocation (£m)
TO1: Strengthening research, technological development & innovation	PA1: Research and innovation	727.5
TO2: Enhancing access to, and use and quality of, ICT	PA2: ICT	100.5
TO3: Enhancing the competitiveness of SMEs	PA3: SME competitiveness	1,415.3
TO4: Supporting the shift towards a low carbon economy in all sectors	PA4: Low carbon economy	685.3
TO5: Promoting climate change adaptation, risk prevention and management	PA5: Climate change adaption	74.3
TO6: Preserving and protecting the environment and promoting resource efficiency	PA6: Protecting the environment	77.6
TO7: Promoting sustainable transport and removing bottlenecks in key network infrastructures	PA7: Sustainable transport In Cornwall and the Isles of Scilly	52.3
TO7: Promoting sustainable transport and removing bottlenecks in key network infrastructures	PA8: Sustainable transport	-
TO9: Promoting social inclusion, combating poverty and any discrimination	PA9: Promoting social inclusion	32.4
-	PA11: Technical assistance	131.1

(Source: MHCLG, 2014, 2021)

Horizontal coordination includes a continuum of cross-cutting work at each MLG level (Figure 13). More intensive modes of cross-cutting working will likely require greater resources to achieve.

Figure 13 | Modes of cross-cutting working



(Source: adapted from Serger, Soete and Stierna, 2023)

Developing strategic, purpose-driven trusting, and cooperative partnerships between local stakeholders and levels of government is an essential element in cross-cutting work. A key first step is the identification of local stakeholders, and their mobilisation to collectively address policy orientation goals. The RIS3 Entrepreneurial Discovery Process emphasises local entrepreneurs and actors within the existing regional innovation system as partners (Laranja, 2022). The Open Discovery Process of the Regional Partnerships of Innovation programme emphasises broader 'coalitions of the willing', including actors typically excluded from innovation activities (Pontikakis et al., 2022a). This recognises innovation systems for transformative change are not given ex ante but may emerge around challenges (Wanzenböck and Frenken, 2020).

Trusting, cooperative relationships within partnerships can be built through continuous engagement and inclusiveness, transparency on rules and consequences, trust-enhancing science communication, simplicity of information and feedback, and co-ordination and collaboration mechanisms (OECD, 2018).

A tension can arise between the need for central control and accountability versus the risk of crowding out intrinsic motivation of partners (Foster, 2017). Motivation can be bolstered by encouraging trusting relations within partnerships, setting challenging and specific goals with the agreement of those actors responsible for their implementation and using a limited number of indicators under the control of the actor in the timeframe being measured (OECD, 2018).

4.3.10 Policy mix

Place-based policies typically involve the integration of a set of policy instruments intended to generate projects that address local specialisation domains and related priorities, and consequently usually have multiple intended outcomes (Barca and McCann, 2011). Understanding the policy complexity that emerges from the interactions and interdependencies between different instruments and linked stakeholder actions, and the extent to which this affects realisation of policy goals is called the 'policy mix' (Flanagan, Uyarra and Laranja, 2011).

Policy design and evaluation are both key to finding the right policy mix for a given regional challenge. The purpose of evaluation can vary depending on level of directionality involved and the extents to which regional innovation priorities emerge through discovery processes (Magro and Wilson, 2019). This highlights the importance of governance arrangements that link different government departments and levels responsible for policy design mix with the local stakeholders involved in discovery-based implementation.

In the EU, design-stage identification and implementation-stage coordination of a robust, flexible policy mix is a building block of the IPbT programme (Bianchi et al., 2024b). This enables the mobilisation of additional policy instruments as required, the sequencing of interventions against other actions to benefit from synergies by design, and the co-option of additional actions by stakeholders (Pontikakis et al., 2022a).

4.4 Policy implementation

Strategy implementation in public policy includes aspects of organisational design, resource management, performance measurement, and change management (Bryson and George, 2020). Below, we highlight activities of specific relevance to regionally focused R&I policy formulation.

4.4.1 Strategy deployment

Deploying a regional R&I strategy begins with the development of an action plan as a distillation of shared development agendas, aspirations, appropriate governance arrangements, delivery mechanisms, scheduling, and support mechanisms. For mission-oriented approaches, multiple mechanisms may be in operation, and policy labs or regulatory sandboxes may be needed to identify the right mechanisms.

4.4.2 Managing prioritisation

The complex and complex adaptive nature of regional economies means that it can be difficult or impossible to know where investment should be prioritised to drive growth and development (HM Government, 2022). Consequently, prioritisation processes are fraught with uncertainty arising from a partial view of the economy, are subject to policy capture by entrenched interests, and are influenced by the capabilities held by governments and other stakeholders (Kuznetsov and Sabel, 2017).

Managing the prioritisation process necessitates a shift of focus away from a one-time ‘picking winners’ approach (i.e. sectors, technologies, industries, firms to be prioritised for preferential intervention) to a process of error detection and error correction of such choices (Kuznetsov and Sabel, 2017). The RIS3 Entrepreneurial Discovery Process is an example of such a process. RIS3 is intended to support the selection of priority domains for specialisation which may encourage agglomeration effects, and to maximise spillovers coming from synergies created through stakeholder collaboration.

In practice, priority domains have often been defined too broadly, narrowing possibilities for specialisation (Esparza-Masana, 2022). The IPbT programme seeks to address this issue by using localised challenges to set investment priorities on domains close to local societal challenges broadly shared and understood by the public, and attract coalitions of the willing to tackle them. The intention is that this can help chart a trajectory for regional industrial restructuring and employment growth (Bianchi et al., 2024a; Molica, Pontikakis and Miedziński, 2025). This approach is currently being used in Catalonia to specify research, education, and knowledge exchange activities that universities could engage in to support IPbT strategies (Generalitat de Catalunya, 2025).

4.4.3 Managing experimentation

The prioritisation process yields a number of projects which can be arranged in portfolios of experiments (Mikkelsen and Røiseland, 2024). Adaptively managing this portfolio represents a Darwinian approach to experiment management (Ansell and Bartenberger, 2016). The purpose is to use the portfolio to create variety and test different ways to succeed in highly uncertain contexts through trial-and-error learning. Resources can be reallocated from unsuccessful to more promising

experiments via monitoring arrangements. The portfolio approach offers a number of advantages, including identification of synergies, supporting scaling and planning across ecosystems, and avoiding policy capture by powerful sectoral actors (OPSI, 2022).

Within the RIS3 Entrepreneurial Discovery Process, the portfolio approach underpins a long-term search for new priority domains for specialisation (Kuznetsov and Sabel, 2017). The aim is to generate knowledge about the future economic value of possible transformational change or the establishment of new sectors which could encourage 'related variety' and contribute to restructuring regional economies (Foray, 2014, 2017; Laranja, 2022; Laranja and Reimeris, 2024). The portfolio approach is also used in IPbT and RIE (Bianchi et al., 2024a; Guzman et al., 2023).

Promising experiments can also be improved through generative experimentation (Ansell and Bartenberger, 2016). This involves the generation of a solution addressing a particular problem within a single experiment, and iteratively refining the solution based on continuous feedback and learning-by-doing (Ansell and Bartenberger, 2016).

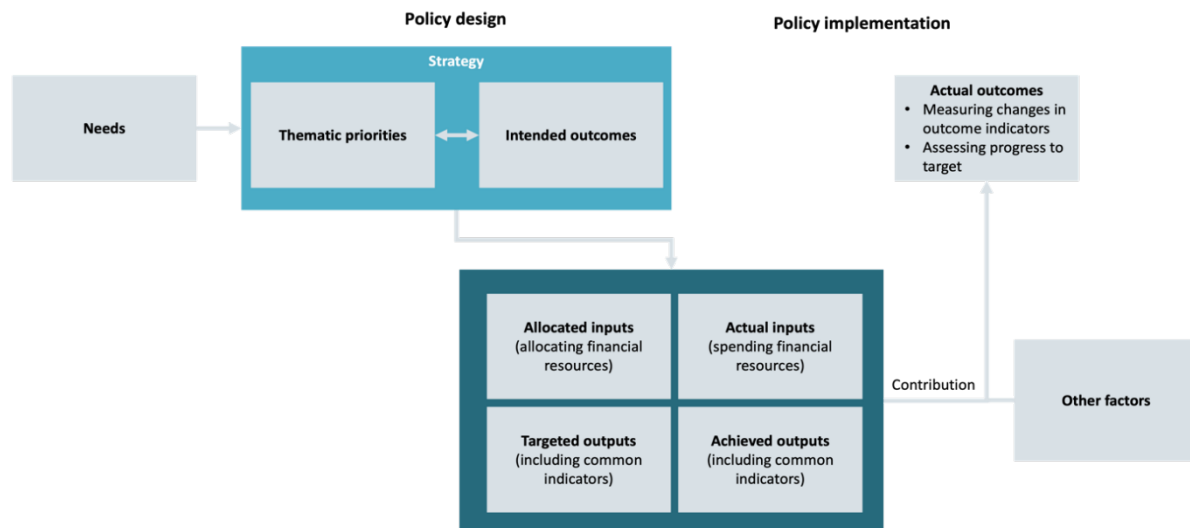
4.4.4 Monitoring and evaluation

A key element of place-based development policy approaches is the outcome-oriented nature of this type of policy-thinking. This requires the development of monitoring and evaluation (M&E) arrangements which clearly distinguish between policy inputs, outputs, and outcomes, and employ both quantitative and qualitative outcome indicators to track policy direction and progress in terms of efficiency (inputs→outputs) and effectiveness (outputs→outcomes). This approach is justified on three grounds (McCann, 2019):

- Thinking ex ante about appropriate outcome indicators helps to tailor policy to the local context
- Outcomes are not known in advance of the project, and this necessitates both outcome indicators and a portfolio management approach which recognises some projects will not succeed
- Outcome indicators bring realism into the project design in terms of aims and ambitions, and helps build capacities.

One of the most comprehensively elaborated outcomes-oriented M&E approaches has been designed for EU cohesion policy (Barca and McCann, 2011). This envisages a framework in which financial resources are allocated (the inputs), aimed at producing planned outputs through which intended outcomes in terms of people's well-being are expected to be achieved (Figure 14).

Figure 14| EU Cohesion policy input, output and outcome framework



(Adapted from Barca and McCann, 2011)

A set of ‘common’ indicators is defined to assist thinking about targeted outputs and track actual outputs (e.g. Appendix C shows indicators used during the last ERDF programme in England). The use of common indicators supports evaluation of policy efficiency as an accountability requirement and enables EU-wide aggregation.

The outcomes-oriented approach does not offer a menu of outcome indicators but instead encourages Member states and regions to choose those indicators most suitable to capture the objectives of their own programmes in accordance with agreed general principles, to track progress towards them, and to report progress periodically. These outcome indicators reflect value judgements about aspects of greatest importance within the region and will vary significantly between regions. Specified principles for the design of place-based outcome indicators include that they should be:

- **Reasonable** – capturing the essence of an outcome according to a reasonable argument about which features of the outcome they can and cannot represent
- **Normative** – having a clear and accepted normative interpretation (i.e. there must be agreement that a movement in a particular direction or within a certain range is a favourable or an unfavourable result)
- **Robust** – reliable, statistically and analytically validated, and, as far as practicable, complying with internationally recognised standards and methodologies
- **Feasible** – built, as far as practicable, on available underlying data, their measurement not imposing too large a burden on Member States, enterprises, nor citizens
- **Debatable** – timely and openly available to a wide public, with room being built for public debate and for their own revision when needed and motivated
- **Responsive to policy** – linked in as direct way as possible and potentially affected by the policy actions for whose assessment they are used, while not being subject to manipulation.

Turning to regionally focused R&I policy, the outcomes-oriented approach is also recommended (McCann, 2019), and is used for a number of policy instruments, including RIS3, IPbT, and RIE. Critically, however, it is not used in isolation. A number of issues arise with its application to innovation, necessitating the use of a range of mitigations in practice. Below we highlight selected issues and mitigations.

Dimension

Dimension refers to the criteria by which a policy's performance or impact is assessed. It encompasses dimensions of evaluation, impact, methodology, governance and analysis (including level of geography).

In terms of geographical dimension, the use of regional economic indicators as outcome indicators is possible, but can be problematic for a number of reasons. First, outcome indicators only correspond to centrally collected regional statistics where it is the reasonable intention of the policy to significantly influence a given well-being dimension covering the population of the whole region, given its level of resource and ambition (Barca and McCann, 2011). Otherwise, the outcome indicator refers only to a sub-section of the population. A mitigation for this is increasingly granular data collection, such as OECD's Local Data Portal which publishes municipal and local data over 100 indicators across 10 themes (e.g. demography, climate, environment, transport, economy) (OECD, 2024).

Second, outcome indicators should be timely and actionable in that they should provide information that guides decision-making. Centrally collected regional statistics can be an inappropriate choice as an outcome indicator because of the time delay in publishing data. For this reason, IPbT eschews the use of regional data collected by EU national statistical offices (Bianchi et al., 2024a).

Third, outcome indicators should be responsive to a given policy measure, but in reality can be divided into two categories: those whose potential responsiveness is expected to be either significant or remote. The use of productivity of the whole regional economy as an outcome indicator when the policy is aimed at promoting knowledge-intensive sectors is an example of the latter (Barca and McCann, 2011). Nonetheless, SIPF employed indicators of regional and sectoral productivity to assess wider impacts (Frontier Economics, 2021).

Regarding dimensions of evaluation, traditional monitoring approaches informed by neo-classical and evolutionary economics focus analysis on efficiency, effectiveness, and additionality as evaluation dimensions (Haddad and Bergek, 2023). This neglects sustainability as an evaluation dimension and consequently does not support innovation directionality decision making. It also ignores the interrelations between economic, inclusive, and sustainable growth at a time when the need to identify complementarities between these policy goals and the limitations of pursuing any one growth type in isolation are increasingly being emphasised (Rodríguez-Pose and Bartalucci, 2024).

A number of mitigations are now emerging to address this issue. IPbT employs a broader range of metrics including environmental, economic equality, and governance (Bianchi et al., 2024a). The European Commission has developed a multidimensional dashboard defining a range of indicators across dimensions of current and future wellbeing, resilience, sustainability, inclusiveness, and institutional capacity and quality (Benczur et al., 2025). Elsewhere, an integrated framework for evaluating system-level transformative innovation policy has been developed and applied to the Swedish BioInnovation Strategic Innovation Programme (Haddad and Bergek, 2023). By contrast, although the RIE M&E arrangements are currently in development, suggested exemplar indicators retain a narrow economic focus (Guzman et al., 2023). SIPF includes assessment of both economic and social impact, but not environmental impact (Frontier Economics, 2021).

Focus of analysis

Focus of analysis refers to the specific aspects of a policy that are being examined, e.g. outcomes, process, cost, theory, stakeholders or systems.

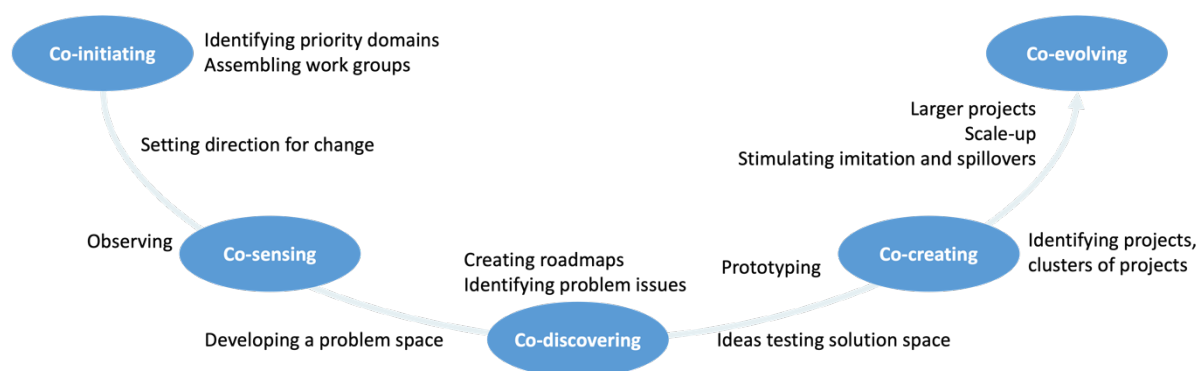
The use of outcomes evaluation alone can be problematic in that this is a backward-looking process that tends to assign guilt for revealed mistakes (Kuznetsov and Sabel, 2017). This does not support a key principle of the place-based approach that policy interventions must be allowed to fail without penalisation in subsequent proposals (McCann, 2019).

A **process-oriented** approach can be used to mitigate this issue. The process-oriented approach recognises that outcomes are unknowable ex ante and instead focuses on getting the process right to enable forward-looking identification of key issues to resolve, unavoidable implementation errors, and remedial measures to address them (Kuznetsov and Sabel, 2017; Rodrik, 2004).

This issue surfaced unexpectedly during the introduction of RIS3 in the form of an experimentation-accountability trade-off, where the experimentation required to mitigate the complex, interrelated, and uncertain nature of place-based R&I policy outcomes is problematic for public administration accountability requirements (Radosevic, Kanellou and Tsekouras, 2023). RIS3 requires experimental governance arrangements because prioritisation decisions made in the Entrepreneurial Discovery Process can only be justified through information generated during experimentation, not through historical data representing past performance (Coffano and Foray, 2014). However, institutional rigidities prevented elements of the policy community, particularly those in less developed regions, from abandoning established vertical 'planning and control' governance models and adopting discovery (Laranja, 2022).

One approach to mitigate this trade-off is the translation of RIS3 and the Entrepreneurial Discovery Process into a process-oriented policy that enables 'emergent strategy' – i.e. where strategy emerges from patterns of behaviour and actions rather than deliberate, top-down planning (Figure 15). This process-oriented approach supports participative monitoring of a range of collaborative processes (i.e. co-initiating, co-sensing, co-discovering, co-creating, and co-evolving).

Figure 15 | RIS3 as a process-oriented policy



(Source: adapted from Laranja, 2022)

Another potential mitigation is adoption of a network governance model which integrates the control and learning dimensions of accountability, allowing continuous feedback loops among stakeholders and ongoing evaluation of and adjustments to activities as programmes are

implemented (Radosevic, Kanellou and Tsekouras, 2023). This approach has been suggested for the IPbT Open Discovery Process (Laranja and Reimeris, 2024).

In terms of **systems focus**, regionally focused policy instruments (including RIE, SIPF, RIS3, and IPbT) emphasise the evaluation of system level impacts. Consequently, there is currently an increasing emphasis on understanding the effects of system dynamics and complexity in policy implementation. A selection of recently published insights in this area is provided in Table 9.

There have also been efforts to accommodate transformative innovation policy’s emphasis on reconfiguring sociotechnical systems towards agreed directionalities (Santos and Coad, 2023). One such has seen the outcomes-oriented approach linked to sociotechnical system change through the design of a set of transformative outcomes (Ghosh et al., 2021). This approach is currently being used in Catalonia’s IPbT strategy to offer a perspective of the trajectories of development of new innovation ecosystems (Fernández et al., 2023).

Table 9 | Selected approaches to understand system dynamics and complexity in policy evaluation

Approach	Reference
Overviews of complexity and systems-based methods in evaluation	(Bicket et al., 2021; HM Treasury, 2020; Palmer and Cavicchi, 2023)
Uses complexity and relatedness measures to understand strengths of an economy’s existing knowledge base and opportunities for diversification and future growth	(Benoit et al., 2025)
System dynamics model to analyse long-term impacts of R&I policy on competitive sustainability	(Czermainski de Oliveira and Cavicchi, 2025)
Analysis of weak signals of disruptive technologies at early stages of development	(Eulaerts, Grabowska and Bergamini, 2025)

Regarding **theoretical focus**, there is increasing use of theory-based evaluation to identify the causal mechanisms that generate policy outcomes as well as the contextual factors that influence them, including theory of change and realist evaluation (Connell et al., 1995; Pawson and Tilley, 1997). IPbT integrates theory-based evaluation with elements from systems dynamics and trajectory measures within its M&E arrangements (Bianchi et al., 2024b; Fernández et al., 2023).

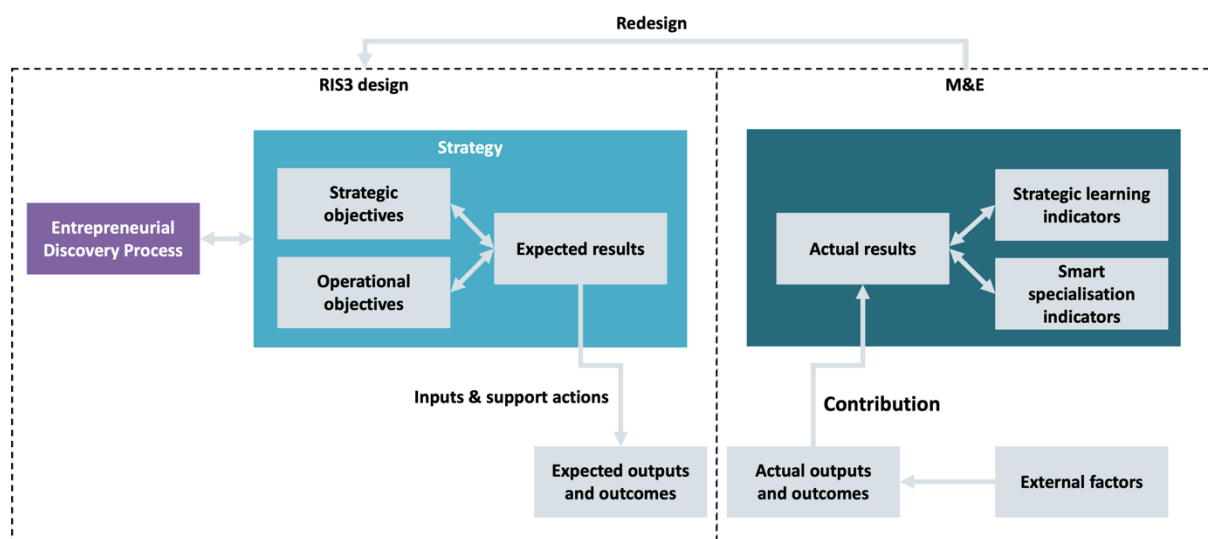
Periodicity

Periodicity refers to the frequency or timing with which evaluations are conducted or with which policy effects manifest and are measured.

Policy evaluation has traditionally focused on summative evaluation of outcomes and impacts to ensure accountability. Increasingly, however, it draws upon a range of M&E approaches that enable both periodic evaluation and reporting as well as continuous monitoring (Arnold et al., 2018; Wise and Arnold, 2022). RIS3 emphasises **diagnostic (problem-solving) monitoring**, the purpose of which is to ask whether one is **doing ‘the right thing’**, as opposed to **outcomes-based M&E’s** focus on whether one **‘does things right’** (Kuznetsov and Sabel, 2017). Transformative policy instruments use **formative evaluation** of implementation processes to understand how and why things happen, and **developmental evaluation** to support real-time reflexive learning and improvements in policy design and implementation (Wise and Arnold, 2022).

In practice, regionally focused R&I policy M&E arrangements tend to augment traditional summative evaluation with these other approaches. Examples include a proposed low-burden approach in which outcomes-based M&E is augmented by arrangements to assess discovery and strategic learning processes that enable RIS3 strategy redesign (Esparza Masana and Fernández, 2019) (Figure 16). IPbT employs a ‘quasi-monitoring, evaluation and adjustment mechanism’ which links continuous monitoring and evaluation of a portfolio with an adjustment governance network mechanism, enabling real-time error detection and correction without replacing conventional M&E (Sergey, Soete and Stierna, 2023). It also emphasises the integration of real-time information from big data analytics with M&E arrangements (Bianchi et al., 2024b). Both RIE and SIPF employ real-time evaluation to support course correction of projects and/or regional growth strategies (Frontier Economics, 2021; Guzman et al., 2023).

Figure 16| Proposed approach to RIS3 M&E



(Source: adapted from Esparza Masana and Fernández, 2019)

Scope

Scope refers to the boundaries and extent of what is included in an evaluation.

A distinction has been drawn between the M&E scope of traditional innovation policy (i.e. beneficiary level outputs, e.g. firms) and that of transformative innovation policy (i.e. multiple system level outputs, including those arising from spillovers and policy interactions) (Santos and Coad, 2023). This raises a need for real-time, regional-level aggregated data which takes into account spillover and policy interaction effects that is not available from national statistical offices.

IPbT extends outcome assessment beyond direct effects at the beneficiary level to include both desired and non-desired spillover effects in the territory and along the entire value chain in a multilevel perspective (Bianchi et al., 2024b). RIE emphasises the importance of distinct but complementary initiatives that together drive the spillovers associated with a higher level of ecosystem performance (Guzman et al., 2023), but it is as yet unknown whether and how spillovers will be measured. SIPF collects evidence on unexpected impacts and spillovers in final evaluation case studies only (Frontier Economics, 2021).

4.4.5 Scaling

Scaling encompasses a range of public sector approaches that encourage the diffusion of an innovative product, approach or idea. These include the replication or dissemination of an innovation in new contexts, domains or geographies (scaling out), identifying opportunities and barriers at broad institutional scales to affect policy or legal change (scaling up), and changing cultural beliefs and dominant social understandings (scaling deep) (van Hout et al., 2024).

The transformative innovation framing places a greater emphasis on scaling than other policy framings (Tödtling, Trippel and Desch, 2022). Consequently, policy designs place different degrees of emphasis on scaling depending on what framing underpins them.

Regarding the policy instruments focused on here, SIPF evaluation includes no specific focus on scaling other than an assumption that projects have broad scalability and potential for follow-ons or spinoffs (Frontier Economics, 2021). RIE emphasises the importance of regional innovative capacity to scale from laboratory to product, and regional entrepreneurial capacity (including accelerator and commercialisation programmes) to scale innovation-driven start-ups (Guzman et al., 2023).

By contrast, a key focus area of IPbT is the scaling of promising experiments to deliver transformational potential. The approach stresses the importance of critical reflection upon which innovation areas should be boosted with policy support, the delineation of innovation areas that hold transformative impact, the identification of appropriate impact pathways, and the development of specific capacities and enabling environments needed to absorb and diffuse existing solutions (Bianchi et al., 2024b).

4.4.6 Learning

The 'Systems of innovation' framing emphasises 'learning by interacting' between knowledge users and producers to encourage innovation (Lundvall, 2012). However, more complex learning and innovation processes offer a path to greater competitive advantage, and therefore growth (Capello and Lenzi, 2018). Here, we highlight a number of other learning processes which are increasingly emphasised in regionally focussed R&I policy, namely collective learning, learning by monitoring, institutional learning, strategic learning, and cognitive learning.

For RIS3, the goal of the Entrepreneurial Discovery Process is to generate information and insights about problems, needs and opportunities relevant to achieving policy goals and to propose policy initiatives in response. This is characterised by a strong collective learning dimension, in that discoveries should be used to inform the whole system about the specific domains of R&D, innovation or human capital formation more or less likely to create new opportunities (Serger, Soete and Stierna, 2023).

Collective learning within RIS3 can be enabled through M&E arrangements in a number of ways. First, through processes in which managing authorities and stakeholders merge their M&E approaches in order to get information useful from all perspectives (known as 'learning by monitoring') (Sabel, 1993). Second, through the use of 'institutional learning' indicators measuring the extent to which a policy instrument has contributed to the institutionalisation and durability of regional networks (Serger, Soete and Stierna, 2023). Third, through the use of 'strategic learning' indicators to evaluate positive effects of any knowledge gathered throughout policy implementation, including the reshaping of regional strategies or design improvements of other policies (Esparza Masana and Fernández, 2019).

The transformative innovation policy framing emphasises the importance of cognitive learning for system change, in addition to learning by interacting and other types of behavioural learning. Cognitive learning includes first-order (single-loop) learning to accumulate knowledge to determine solutions to specific contextual problems, second-order (double-loop) learning involving continuous reflectivity and challenging of assumptions and perceptions of worldview and problem solving and definition, and unlearning as the abandonment of obsolete practices and ineffective habits (Ghosh et al., 2021). IPbT includes arrangements that encourage critical collective reflection and continuous learning from evidence collected through M&E and foresight, in addition to strategic and institutional learning (Bianchi et al., 2024a).

The importance of strategic learning is also recognised in the policy designs of other countries. RIE emphasises learning that allows for real-time course correction (Guzman et al., 2023). SIPP enables learnings from evaluation activities to be used to inform future policy design and changes to the funding landscape and regulatory environment (Frontier Economics, 2021). This may address, to some extent, a recognised learning failure in the UK policy framework targeting regional economic disparities, caused by inadequate feedback mechanisms from local outcomes to the national policy process. (Coyle and Muhtar, 2023).

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Appendix A: Organisational- and regional-level capitals

Table A.1 | Selected organisational-level capitals

Capital type	Description
Human	Assets controlled by the organisation but embodied in and owned by individuals associated with the organisation, e.g. experience, knowledge, education, creativity, judgment, abilities and skills
Technology/IP & know-how	Technology and knowledge-based assets, know-how, specialised production processes and tools
Information	Assets developed by the organisation, including databases, information systems, networks, and technology infrastructure
Relational	External assets which the organisation needs or which affect it, such as the suppliers, customers, regulators and partners
Physical	The organisation's land, buildings, equipment, raw materials and products
Organisational	Assets developed by the organisation, e.g. brand, image, reputation, systems and processes, organisational structures, strategy and strategic alignment, corporate culture, and contractual arrangements
Monetary	The organisation's cash or other financial assets which are equivalent to, or can be converted to cash

(Source: Kelleher and Ulrichsen, 2024)

Table A.2 | Selected regional-level capitals

Human capital	Knowledge, skills, competencies and other attributes (e.g. health) embodied in individuals or groups acquired during their life and used to produce goods, services or ideas in market circumstances (Westphalen, 1999)
Knowledge capital	Based on assets not necessarily embodied, e.g. ideas, knowledge stocks, intellectual property, accumulated best practices and ways of doing things, databases, entertainment, artistic and literary content, design, software, market research and branding, training, and business process reengineering (Haskel and Westlake, 2018)
Social-institutional capital	Social capital refers to social networks, personal relationships, norms, trust and civic engagement that facilitate co-ordination and cooperation for mutual benefit (Putnam, 1993). Institutional capital refers to the potential to build and mobilise social and knowledge capital towards specific goals (Healey, 1998). This includes quality of leadership and the capacity, capability and reliability of local and devolved governance institutions, rule of law and lack of corruption, protection of property rights, financial institutions, freedom for new ideas, and general ease of doing business (Budden, Murray and Turskaya, 2019)
Natural capital	Environmental stocks and systems that generate benefits for people (including ecosystems, raw materials, and a stable climate) (Bennett Institute, 2020)
Physical capital	Scale and quality of infrastructure, homes, machines and equipment, information and communications technology and other tangible assets
Financial capital	Economic resources used to buy inputs to make products or provide services, and is distinct from fixed assets

(Source: Kelleher and Ulrichsen, 2024)

Appendix B: Organisational- and regional-level capacities and capabilities

A range of management, human and technological capabilities necessary for organisations to innovate have been identified (OECD/Eurostat, 2018). A selection is highlighted below.

Table B.1| Organisational capacities and capabilities

Capability/capacity	Description
Dynamic capabilities	A firm’s high-level abilities to identify and assess opportunities (sensing), mobilise assets and competencies to address and capture value from the opportunity (seizing), and continually renew the organisation’s assets and competencies to build and maintain competitive advantage in dynamic market environments (transforming) (Teece, Pisano and Shuen, 1997)
Innovation capabilities	<p>Product innovation capability enables firms to pool, link, and transform assets to create products or services that are incrementally or radically different from existing ones (Menguc, Auh and Yannopoulos, 2014)</p> <p>Process innovation capability enables firms to incrementally improve existing internal processes used to convert assets into products or services, and to introduce radically new processes that make existing processes obsolete (Mikalef and Krogstie, 2020)</p> <p>Marketing innovation capability enables firms to meet customer needs, develop new markets, or position products and services in the market (Nwachukwu, Chladkova and Fadeyi, 2018)</p>
Absorptive capacity	Enables firms to identify, assimilate, and exploit knowledge from the external environment (Cohen and Levinthal, 1990)
Entrepreneurial capabilities	Firm’s capacity to sense, select, shape, and synchronise internal and external conditions and assets for the exploration (recognition, discovery, and creation) and exploitation of opportunities (Abdelgawad et al., 2013)

(Source: Kelleher and Ulrichsen, 2024)

Table B.2| Regional capacities and capabilities

Capability/capacity	Description
Innovative capacity ¹ and capability	<p>A core competency comprised of local institutions and resources that supports and sustains innovative activity, moving both the area and industry forward (Feldman, 1994, p.77). This includes a ‘generative capacity’, referring to the generation of new ideas and technologies through scientific discovery (Kempton et al., 2014; Kitson, 2019; Rinaldi et al., 2018).</p> <p>Regional innovation capability involves the efficient allocation of innovative resources, creation of new ideas and their transformation into new products or services, and adoption in practice (Park, Anderson and Seo, 2021).</p>
Entrepreneurial capacity	<p>Capabilities and conditions in a location for forming enterprises of all types (Budden, Murray and Turskaya, 2019). It encompasses ‘entrepreneurship capacity’, referring to capabilities and conditions specific to forming ‘innovation-driven enterprises’ that pursue global opportunities based on bringing to customers new innovations that have a clear competitive advantage and high growth potential (Aulet and Murray, 2013).</p>
Absorptive capacity	<p>The ability of regional firms to identify, assimilate, and apply external information to commercial ends, individually and collectively (Miguélez and Moreno, 2015). This can increase the ability of the region itself to understand and transform inflows of extra-regional knowledge, and the speed at which technology transfer within, and into, a region occurs.</p>
Collaborative capacity	<p>The ability to collaborate within regional innovation systems and thereby overcome sectoral and disciplinary silos that reproduce old habits and routines that lock regional economies into traditional development paths (Kempton et al., 2014; Rinaldi et al., 2018).</p>
Institutional capacity	<p>The concept of institutional capacity has evolved over time, from an initial focus on strengthening individual public sector organisations’ abilities to effectively and efficiently perform their functions to a broader focus on empowerment, social capital, an enabling environment, and the culture, values and power relations that influence behaviour (Willems and Baumert, 2003).</p>
Transformative capacities and dynamic capabilities	<p>Abilities to shape and coordinate action towards collectively agreed transformational goals. These capacities and capabilities enable the design and implementation of effective transformative policies which offer long-term stability and short-term agility (Borrás et al., 2023; Janssen et al., 2023; Kattel, 2022; Laranja and Pinto, 2023).</p>

(Source: Kelleher and Ulrichsen, 2024)

Appendix C: ERDF priority axes and performance indicators

Priority axis (PA)	Investment priorities	Output indicator
PA1: Research and innovation	1a: R&I Infrastructure	C25 Number of researchers working in improved research facilities P2 Public or commercial buildings built or renovated (sqm)
	1b: R&I Enterprise & Collaboration	C1 Number of enterprises receiving support C2: Number of enterprises receiving grants C3 Number of enterprises receiving financial support other than grants C4 Number of enterprises receiving non-financial support C5 Number of new enterprises supported C6 Private investment matching public support to enterprises (grants, £) C7 Private investment matching public support to enterprises (non-grants, £) C8 Employment increase in supported enterprises C26 Number of enterprises cooperating with research entities C28 Number of enterprises supported to introduce new to the market products C29 Number of enterprises supported to introduce new to the firm products P2 Public or commercial buildings built or renovated (sqm)
PA2: ICT	2a: Broadband Infrastructure	C1 Number of enterprises receiving support C5 Number of new enterprises supported P3 Additional businesses with broadband access of at least 30Mbps
	2b: ICT in Enterprise	C1 Number of enterprises receiving support C5 Number of new enterprises supported C29 Number of enterprises supported to introduce new to the firm products P4 Additional businesses taking up broadband with speeds of at least 30Mbps
PA3: SME competitiveness	3a: Start-up Support	C1 Number of enterprises receiving support C2 Number of enterprises receiving grants C3 Number of enterprises receiving financial support other than grants C4 Number of enterprises receiving non-financial support C5 Number of new enterprises supported C6 Private investment matching public support to enterprises (grants, £) C7 Private investment matching public support to enterprises (non-grants, £) C8 Employment increase in supported enterprises C28 Number of enterprises supported to introduce new to the market products P2 Public or commercial buildings built or renovated (sqm) P11 Number of potential entrepreneurs assisted to be enterprise ready
	3c: SME products, services, and development capacity	C1 Number of enterprises receiving support C2 Number of enterprises receiving grants C3 Number of enterprises receiving financial support other than grants C4 Number of enterprises receiving non-financial support

		<p>C5 Number of new enterprises supported</p> <p>C6 Private investment matching public support to enterprises (grants, £)</p> <p>C7 Private investment matching public support to enterprises (non-grants, £)</p> <p>C8 Employment increase in supported enterprises</p> <p>C29 Number of enterprises supported to introduce new to the firm products</p> <p>P2 Public or commercial buildings built or renovated (sqm)</p> <p>P13 Number of enterprises receiving information diagnostic and brokerage support</p>
	3d: SME market growth	<p>C1 Number of enterprises receiving support</p> <p>C2 Number of enterprises receiving grants</p> <p>C3 Number of enterprises receiving financial support other than grants</p> <p>C4 Number of enterprises receiving non-financial support</p> <p>C5 Number of new enterprises supported</p> <p>C6 Private investment matching public support to enterprises (grants, £)</p> <p>C7 Private investment matching public support to enterprises (non-grants, £)</p> <p>C8 Employment increase in supported enterprises</p> <p>C29 Number of enterprises supported to introduce new to the firm products</p> <p>P2 Public or commercial buildings built or renovated (sqm)</p> <p>P13 Number of enterprises receiving information diagnostic and brokerage support</p>
PA4: Low carbon economy	4a: Renewable energy production	<p>C1 Number of enterprises receiving support</p> <p>C5 Number of new enterprises supported</p> <p>C30 Additional capacity of renewable energy production (MW)</p> <p>C34 Estimated annual decrease in GHG (Tonnes of CO₂EQ)</p>
	4b: SME energy efficiency & renewable take-up	<p>C1 Number of enterprises receiving support</p> <p>C34 Estimated annual decrease in GHG (Tonnes of CO₂EQ)</p>
	4c: Public and commercial energy efficiency & renewable take-up	<p>C31 Number of households with improved energy consumption classification</p> <p>C32 Decrease of annual primary energy consumption of public buildings (KWh/year)</p> <p>C34 Estimated annual decrease in GHG (Tonnes of CO₂EQ)</p>
	4e: Low carbon strategies	<p>C1 Number of enterprises receiving support</p> <p>C34 Estimated annual decrease in GHG (Tonnes of CO₂EQ)</p>
	4f: Low carbon R&I	<p>C1 Number of enterprises receiving support</p> <p>C5 Number of new enterprises supported</p> <p>C26 Number of enterprises cooperating with research entities</p> <p>C29 Number of enterprises supported to introduce new to the firm products</p> <p>C34 Estimated annual decrease in GHG (Tonnes of CO₂EQ)</p>
PA5: Climate change adaption	5b: Climate change adaptation	<p>C23 Surface area of habitats supported in order to attain a better conservation status (ha)</p> <p>P6 Business and properties with reduced flood risk</p>
PA6: Protecting the environment	6d: Green and blue infrastructure	<p>C22 Total surface area of rehabilitated land (ha)</p> <p>C23 Surface area of habitats supported in order to attain a better conservation status (ha)</p>

	6f: Environmental and resource efficiency R&I	C1 Number of enterprises receiving support C5 Number of new enterprises supported C29 Number of enterprises supported to introduce new to the firm products
PA7: Sustainable transport In Cornwall and the Isles of Scilly	7a: TEN-T network investment	C14a Total length of reconstructed or upgraded roads of which: TEN-T (km) P7 Length of railway with new or enhanced signalling installation (km)
	7c: Low carbon transport investment	P8 Alternative fuel charging/re-fuelling points P9 Improved multi-modal connection points P10 Number of multi-modal transport hubs
PA9: Promoting social inclusion	9d: Social inclusion strategies	C1 Number of enterprises receiving support C5 Number of new enterprises supported C8 Employment increase in supported enterprises P11 Number of potential entrepreneurs assisted to be enterprise ready P12 Public or commercial building built or renovated in targeted areas (sqm)

(Source: MHCLG, 2021. 2014-20 English ERDF Operational Programme)

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