Transforming and Strengthening Innovation Systems in Developing Economies.

Learning from International Experience and Clarifying Concepts

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Executive Summary

Over the past 20 years support for innovation has become a growing component of the programs and strategies of most international development agencies – bilateral and multi-lateral agencies and major foundations. This report provides an overview of that development.

The systems perspective is now a dominant framework for innovation policy in all countries. While many development assistance programs have increased support for innovation, for example through challenge funds, their emphasis is now more on increasing innovation capability. From a systems perspective the challenge for international development assistance becomes how best to strengthen innovation systems in Low and Low Middle Income Countries (LLMICs) – which raises a range of issues much wider than science and technology (and particularly R&D) capability. With the rising importance of inclusion and sustainability goals, as expressed in the Sustainable Development Goals (SDGs), the direction of innovation system development becomes an explicit policy issue - which raises challenges beyond increasing economic growth.

There are innovation system lenses or frames at the macro level (national innovation systems), and at the meso level (regional and sectoral innovation systems). Two innovation system frameworks particularly relevant for innovation system strengthening in LLMICs are at the lower end of the meso level and draw also on some different conceptual building blocks: innovation ecosystems and entrepreneurial ecosystems.

Both of these frameworks have been criticized for their under-developed theoretical foundations. The most significant weakness, which they share with innovation systems frameworks more generally, is the lack of a strong theory of system genesis and evolution. Nevertheless, these frameworks are widely used and there have been pragmatic attempts to address the need for guidelines to ecosystem strengthening.

Entrepreneurship is an essential component of a dynamic national or regional innovation system. In a context of technological and social change and high levels of uncertainty, entrepreneurial activity – ie in the case of the business sector, conducting business experiments – has long been critical for discovering new paths of value creation. In OECD economies, as the potential for entrepreneurship was recognised, new types of organisation and institution emerged to support entrepreneurial activity: venture capital, incubators, accelerators, new types of equity exchanges, entrepreneurship training programs etc. These developments illustrate the importance of organisational and institutional innovation in enabling and supporting technological innovation and entrepreneurship.

Neither the national innovation system of the OECD economies, nor the high performing entrepreneurial ecosystem of Silicon Valley, developed as a result of purposive design at the system level. They evolved over long periods in response to opportunities and problems, and a myriad of other contingent factors. Policies and interventions that shape the evolution of innovation and entrepreneurial systems are now informed by systems perspectives and hence by some level of ambition regarding purposive system design. Insights from our growing knowledge of innovation processes and innovation system development should be taken into account in strategies to strengthen innovation systems in LLMICs.

However, many types of barriers (or 'system failures') inhibit the development of ecosystems in LLMICs. The informal sector generally plays a much larger role in the economy, and there are weak links between the organisations in this sector and those in the formal sector. The capabilities of most firms to absorb and apply new knowledge are often weak. It is challenging to identify which barriers should be addressed first and how best to do so. It is equally challenging to steer or re-orient innovation system development toward inclusion and sustainability goals, particularly if the explicit (and implicit) policy context does not support those goals. Enabling marginalised groups to build agency in order to participate in innovation system development is often a key challenge. Again, there have been useful attempts to develop frameworks for innovation systems strengthening while addressing inclusion and sustainability goals.

As noted, among international development assistance organisations and major foundations support for innovation is increasing and is increasingly influenced by the innovation systems perspective. This brings substantial challenges for these organisations. It involves experimenting with new approaches, building new skills among staff, developing relationships with new organisations (domestically and within LLMICs) and rethinking effective monitoring and evaluation. Project planning based on rigid logframe

approaches and very lean administration and management budgets are less appropriate when higher levels of flexibility and ongoing adaptation are necessary. Similarly, it is clear that the tendency to pursue 'innovation push' approaches, which were seen as avoiding the need for engagement with the complexity of local contexts and the dynamics of demand, has run its course.

The International Development Innovation Alliance (IDIA) is an organisation of 15 aid organisations that support innovation in LLMICs. A 2021 draft report by IDIA reviews members' experience with programs aiming to strengthen innovation systems in LLMICs. The review identifies 40 relevant programs by members and locates these across a spectrum of approaches from 'entrepreneurial support, through 'innovation processes' to 'mission-driven'. The review also assesses the extent to which each of these programs pursues nine specific ecosystem development foci. A Swedish International Development Cooperation Agency (Sida) Position Paper, which draws on over 20 years of experience supporting innovation capability in LLMICs, also identifies different foci for programs and sets out guidelines for future interventions. Sida has had an emphasis on the role of research-user linkages, viewed through the lens of the 'triple helix' perspective. The insights from the IDIA review and the Sida Position Paper are discussed and also contribute to the overall assessment of international experience in the final Section.

Overall, there are several markedly different approaches to innovation support, each with specific objectives and modalities. We characterise six major approaches:

- entrepreneurial orientated
- innovation process orientated
- innovation policy oriented
- multi-level / portfolio orientated
- platform technology-oriented
- mission oriented.

Detailed case studies of examples of each of the first five of these types of innovation support program are in Appendix 1 - the experience summarised in these case studies also contribute to the overall review.

Clarity about the barriers to the emergence, growth and performance of an innovation system /entrepreneurial ecosystem is critical for effective diagnosis and intervention design. The intervention logic in each of these six approaches focuses on different types of 'system failure' - from an innovation systems perspective the barriers to innovation performance are due to failures at the level of the system structure and functioning, rather than (or in addition to) market failures.

The final Section assesses what we can learn from the diverse experience of international development support organisations. A wide range of issues are discussed, ranging from better understanding of the constraints on system emergence in LLMICs, to recognition of the importance of non-technological entrepreneurship and innovation, to questioning the extent of emphasis on local R&D organisations.

Turning to the future, the report notes that innovation policy in LLMICs must address three concurrent and unavoidable challenges:

1. mastering current technologies in order to raise performance in domestic industries and improve domestic value-adding and employment, build infrastructure to enable growth and upgrade in global value chains
2. building capability in platform technologies - new digital technologies and biotechnology - particularly to effectively apply these technologies in key sectors
3. addressing growing challenges of climate change and of inequality across regions and social groups.

Drawing on international experience the report identifies eight principles for strengthening innovation systems in LLMICs:

- Using a learning plan approach to address complexity, uncertainty and multiple market, systems and transformational failures
- Using a collaboratively developed theory of change
- Applying an adaptive management and ensuring that project governance, management and budgeting reflect that approach

- Probing, experimenting and learning, collaboratively
- Recognising that, as technologies, organisations and institutions co-evolve, all forms of innovation are important for growth and transformation
- Recognising that innovation system growth is an endogenous process, driven by opportunities (and the appropriation of benefits), problems and participants' endeavours and investments
- Entrepreneurship in all its forms is a vital component of innovation systems
- Effective support of change is likely to require sustained and flexible support.

1. Introduction

Support for innovation has over the past 20 years become a growing component of the programs and strategies of most international development agencies – bilateral and multi-lateral agencies and major foundations. This report provides an overview of that development. Approaches to supporting innovation vary widely. The report explores the types of program that have been undertaken, develops a typology of the most common models and includes exemplar case studies of five of these.

Drawing on these case studies, evaluations of other programs and a growing international literature, the report seeks to understand programs' objectives and logics of intervention. While recognising the very limited number of systematic long-term evaluations, the report reviews evidence for programs' effectiveness in driving innovation and innovation capacity. It also discusses how impacts have been assessed.

With that background, the report focuses on the question: what can we learn from this diverse international experience in order to inform the design, governance and management of programs aiming to strengthen innovation systems in low and lower middle-income countries (LLMICs)?

The following part of the report (Section 2) provides an introduction to the relevance of innovation systems approaches for innovation capability development in LLMICs. It discusses innovation ecosystems and entrepreneurial ecosystems, both useful and widely applied frameworks for policy analysis and development. The section also discusses the types of barrier or systems failures that inhibit the emergence and growth of innovation/entrepreneurial ecosystems in LLMICs – and how these barriers might be addressed. Incorporating goals of social inclusion and of environmental sustainability are additional challenges for innovation/entrepreneurial ecosystems strengthening strategies.

Section 3 and Section 4 review the role of international development assistance agencies and major foundations in supporting innovation system strengthening in LLMICs. Section 3 outlines the growing focus on innovation and more recently on innovation systems. It then focuses on the experience of the agencies and foundations with a particular focus on innovation system strengthening. Section 4 introduces a set of five detailed case studies (compiled in the Appendix).

Section 5 draws on the previous sections to discuss the key insights and lessons from international experience. It then identifies eight broad principles for the design of initiatives aiming to strengthen innovation systems in LLMICs.

2. Innovation and Innovation Systems

Introduction

Systems approaches to innovation policy are now highly influential internationally. As a result, initiatives to increase innovation capacity and activity in all countries are informed by an innovation systems perspective. In the context of low and lower middle-income countries (LLMICs) a particular focus is on strengthening their innovation systems. Similarly, along with growing awareness of the importance of entrepreneurship there has been an increasing focus on strengthening the systems – the entrepreneurial ecosystems – that support entrepreneurs. More recently, in both developed and developing countries, innovation policy has begun to address the challenges of increasing inequality and environmentally unsustainable growth. This raises questions about how to re-orient, and perhaps transform, innovation systems to better respond to goals of inclusion and sustainability. This raises new questions about the governance of innovation systems that have developed as open complex adaptive systems without overall governance.

This section provides an introduction to these concepts and their relevance for innovation in LLMICs.

Innovation and Innovation Systems

Recognition of the potential role of innovation for achieving development objectives has led to the recognition that innovations develop and evolve in complex systems, involving organisations, their relationships and the broader resource and institutional context that shapes their behaviour and the outcome of innovation efforts. However, there are a number of conceptual frameworks, at the micro, meso and macro level, for understanding and analysing innovation-related systems.

This systemic perspective on innovation now provides the foundation for innovation policy in most OECD countries and is increasingly influential in all countries[1]. While the perspective that had wide influence was focused at the national level, as national systems of innovation, the systems perspective has now been extended and applied at the regional and sectoral level. Two complementary approaches, that draw on additional related concepts, and are now widely also used for assessment and policy development (usually at a city or locality level) are those of entrepreneurial ecosystems and innovation ecosystems.

At the macro-level the concepts of national innovation systems have been extensively developed through theoretical and empirical research, have been applied to analyses in a diverse range of countries and become an influential framework for innovation policy.

The majority of aid initiatives that seek to facilitate innovation system change are at the meso-level – ie within a geographic area or within a sector – where a limited range of actors and technologies are in scope. At this level there are a number of relevant conceptual frameworks: regional innovation systems, sectoral innovation systems, entrepreneurial ecosystems and innovation ecosystems.

At the micro-level many aid organisations have sought to incorporate innovation in all aspects of their operation and become in some respects 'innovative organisations'. This is undoubtedly a useful development and is likely to contribute to these organisations playing a more effective role in fostering innovation-support initiatives in LLMICs.

Whichever innovation system framework is used it is vitally important to emphasise the systemic foundation of capability and performance and the evolutionary nature of change. With their focus on a narrow range of both actors and geographies the entrepreneurial ecosystems and innovation ecosystems appear to be most relevant for this discussion.

- **Entrepreneurial Ecosystems**
  Recognition of the social and cultural dimensions of entrepreneurial activity and an interest in policy approaches to promote entrepreneurship has led to a shift of focus from studies of entrepreneurs and ventures to interest in how entrepreneurial ecosystems develop and function (Acs, Stam, Audretsch, & O'Connor, 2017; Auerswald, 2015; Brown & Mason, 2017; Roundy et

[1] For example: Eklund, Magnus, 2007.Adoption of the Innovation System Concept in Sweden, Uppsala Studies in Economic History 81, Uppsala,n Sweden.

al., 2018; Stam, 2015). Despite its extensive use, the entrepreneurial ecosystem concept remains contested[2]. Alvedalen and Boschma (2017) consider that the concept lacks:

- a clear analytical framework theorising cause and effects relationships;
- an approach to understanding interactions and identifying those that are most important;
- a theory addressing the factors that shape structure and performance; and
- a strong empirical base of longitudinal studies of ecosystem evolution[3].

- **Innovation Ecosystems**

  The concept of innovation ecosystem has developed relatively recently and is a hybrid of the business ecosystem, sectoral innovation system and technology innovation system frameworks. The term "ecosystem" is most often used in the business literature to characterize the links around a core of anchor firm and embodies the idea of the co-creation of value and hence of levels of inter-dependence within an ecosystem. With its origins in business ecosystems, the corporate strategy perspective is a major influence, in contrast to the institutional and policy focus in the wider innovation systems literature[4]. Although the linking of 'ecosystem' and 'innovation' suggests a robust theoretical and practical framework, it is a contested concept with no well-established definition[5]. Nevertheless, the concept could be useful for diagnosis and strategies at the lower end of the meso-scale; but that will require the development of a richer conceptual framework. Innovation ecosystems are generally seen as anchored in a, or a family of, related technologies and the actors linked to their development and application. One particularly important avenue of conceptual development is to incorporate understanding of the dynamics of ecosystem emergence and evolution. This will involve concepts regarding barriers to growth and change, the scope for collective action, the role of institutions, the development of legitimacy. Insights from the literature on socio-technical transitions can contribute to this conceptual development.

Entrepreneurial and innovation ecosystems are generally seen as sharing core elements:

- actors- firms, other organisations and individuals – and their relationships
- infrastructure of many types
- institutions, including regulations
- knowledge and ideas.

Both can be seen as complex adaptive systems in that they share properties of:

- self-organization
- open but distinct boundaries
- complex components
- non-linearity,
- adaptability, and
- sensitivity to initial conditions[6].

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[2] Alvedalen, J. and Boschma, R., 2017. A critical review of entrepreneurial ecosystems research: Towards a future research agenda. European planning studies, 25(6), pp.887-903.

[3] De Bernardi, D. Azucar, 2020. Innovation in Food Ecosystems, Contributions to Management Science, Springer Nature Switzerland AG

[4] Granstrand, O. and Holgersson, M., 2020. Innovation ecosystems: A conceptual review and a new definition. *Technovation,90*; Rabelo, R. J., Bernus, P., & Romero, D. (2015). Innovation ecosystems: A collaborative networks perspective. In Working conference on virtual enterprises (pp. 323–336). Cham: Springer; Autio & Thomas, 2014, define an innovation ecosystem as: a "*network of interconnected organizations, organized around a focal firm or a platform, and incorporating both production and use side participants, and focusing on the development of new value through innovation*". Autio, E. and Thomas, L., 2014. *Innovation ecosystems* (pp. 204-288). The Oxford handbook of innovation management.

[5] Oh, Deog-Seong, Phillips, Fred, Park, Sehee, Lee, Eunghyun, 2016. Innovation ecosystems: a critical examination. Technovation 54, 1–6.; Gomes, A., et al, 2018. Unpacking the Innovation Ecosystem Construct: Evolution, Gaps and Trends. Technology Forecasting and Social Change. 136, 30–48; Adner, R. (2017). Ecosystem as structure: An actionable construct for strategy. Journal of Management, 43(1), 39–5

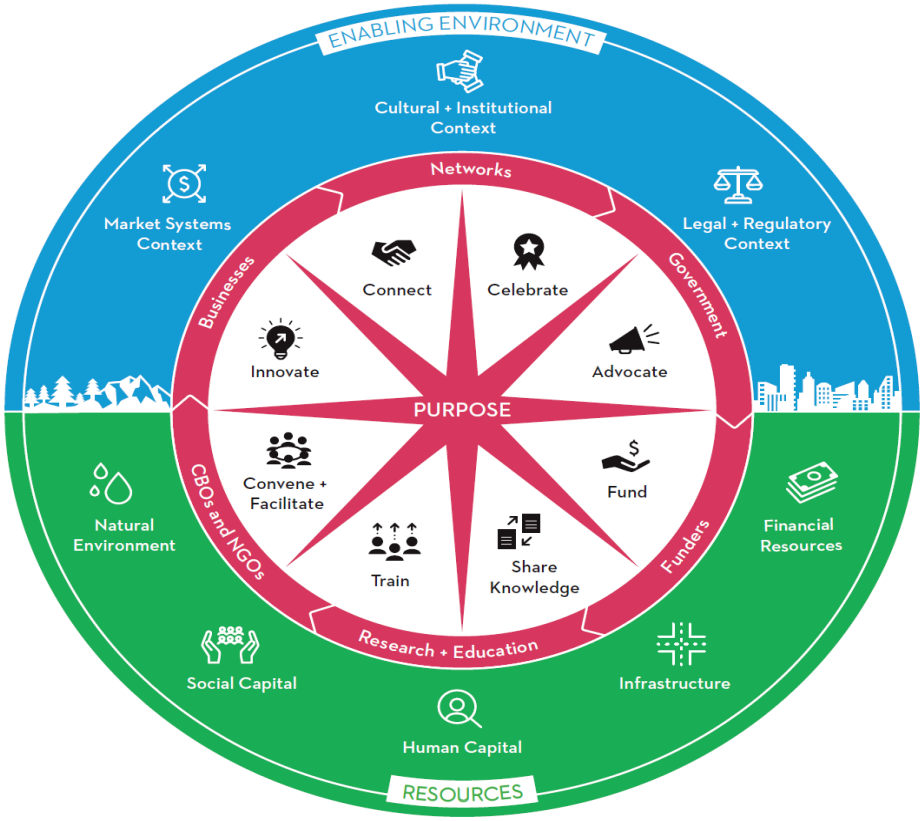
[6] De Bernardi, D. Azucar, 2020. Innovation in Food Ecosystems, Contributions to Management Science, Springer Nature Switzerland AG, p.83 based on: Roundy, P. T., Bradshaw, M., & Brockman, B. K. (2018). The emergence of entrepreneurial ecosystems: A complex adaptive systems approach. Journal of Business Research, 86, 1–10,

Notwithstanding questions about the theoretical and empirical foundations of entrepreneurial and innovation ecosystem frameworks, their application in development practice is well-established. One example, and a useful articulation of the concept, is that of Hoffecker, 2019, as illustrated in Figure 2.1[7]. The elements of this framework are set out in Table 2.1 below. As with the innovation systems concepts, the characteristics of actors, roles, resources and the environment for innovation in a specific context shape the opportunities for innovation, and the types of innovation that develop, in that context. Missing actors, roles not fulfilled (particularly finance and coordination), resources constraints and unsupportive environments limit the growth and even the emergence of an innovation ecosystem. These types of constraint and a lack of a shared vision, lack of trust, weak links among actors and an institutional context not conducive to innovation are common barriers to innovation ecosystem development. These are similar to the types of 'systems failure' identified in the literature on innovation systems- and discussed in Section 4.

While noting that approaches to ecosystem strengthening begin by diagnosing the stage of development and the sources of weakness in the innovation ecosystem, the main elements of strategies for that strengthening that Hoffecker (2019) identifies are[8]:

- identify a shared vision
- start with the motivated champions
- facilitate safe, neutral spaces for developing shared agendas
- establish a common language and shared conceptual framework
- build on what is already working well
- set achievable, "next step" goals
- create opportunities for capability development effective for actors in this ecosystem
- celebrate progress publicly.

Figure 2.1 Local innovation ecosystem model[9]



[7] Hoffecker, Elizabeth. 2019. Understanding Innovation Ecosystems: A Framework for Joint Analysis and Action. Cambridge: MIT D-Lab.
[8] Modified from Hoffecker, 2019, p.11.
[9] Hoffecker, 2019, p.5

Table 2.1 Ecosystem Elements[10]

Actors

Businesses of various sizes, ranging from start-ups and SMEs to large firms;

Community- organisations and not-for-profit organizations (CBOs and NGOs);

Knowledge organisations - centers and institutes of R&/or D, education and training;

Funders providers of funding, including grant funding as well as financial products and services;

Public sector - governments and government agencies, particularly local and regional bodies; and

Networks - networks, alliances, associations, and groups of individuals, both formal and informal

Key Roles

Innovate- identify, develop, and put into use new and improved ways of doing; diversity among actors that can innovate and build value from innovation contributes to stronger ecosystems

Connect - social networking or value chain development to connect and develop trust among actors.

Celebrate - promoting local innovators and creating a supportive culture for innovation.

Train – capacity building in terms of skill, knowledge and outlook.

Share Knowledge – knowledge transfer of all types among actors.

Convene and Facilitate - facilitating productive, mutually beneficial interactions among diverse members of the ecosystem

Advocate - Advocacy for the conditions needed to support innovation by addressing system-level constraints and barriers.

Key Resources

Natural Environment - locally relevant constraints, opportunities and challenges related to natural capital and ecological resources

Human Capital - knowledge, skills, capacities, and competencies that enable people to participate in innovation and value creation.

Social Capital - information, trust, and norms of reciprocity that enable 'mutually beneficial collective action'.

Infrastructure - physical infrastructure, networks, systems, and facilities (labs, maker spaces, fabrication centers, etc.), both tangible and intangible, necessary for innovation and innovation-oriented economic activity.

Financial Resources - the types and quantities of funding, financial products, and related services that are available to innovators to support innovation and diffusion of innovation.

Environmental Elements

Market Systems Context - the economic systems through which actors collaborate, coordinate, and compete for the production, distribution and consumption of goods and services: value chains, end markets and households, and input and service markets.

Cultural and Institutional Context - cultural beliefs, values and customs as well as formal and informal rules, standards, norms, and shared habits (collectively referred to as "institutions") that produce predictable routines of behaviour and interaction.

Regulatory and Policy Context - laws, regulations, and policies that exist in a location, as well as the manner and extent to which they are enforced, that create incentives disincentives for innovation.

Evolution of Innovation Systems

It is important to note that the initial innovation system concepts were developed in order to understand the characteristics of well-developed and relatively high-performing innovation systems of OECD economies.

Our interest here is less in the characteristics of ideal mature innovation systems than in how innovation systems emerge and evolve in different contexts. In a context of substantial change innovation

[10] Hoffecker, Elizabeth. 2019. Understanding Innovation Ecosystems: A Framework for Joint Analysis and Action. Cambridge: MIT D-Lab. p.6-9

system/ecosystem development will also involve entrepreneurship and this dimension of innovation will be enhanced if there is also a strong entrepreneurial ecosystem.

The formation of national innovation systems was seen as the outcome of diverse and complex processes and not the result of purposive design[11]. Nevertheless, throughout the world there are countless ambitious efforts to design and build innovation and entrepreneurial ecosystems and several attempts to conceptualise the process and stages of ecosystem evolution[12]. While there are good reasons to be cautious about the scope for purposive design, particularly where there is an attempt to *a priori* map the path of growth and evolution, it is reasonable to see the origins of many purposive innovation and entrepreneurial ecosystems developments in the formation, as a founding generative institution, of a shared vision or mission among key stakeholders.

Whether emerging as a complex adaptive system or shaped by detailed purposive design, the evolution of an innovation system typically confronts a range of barriers. Many types of barrier shape the path of evolution and the particular, perhaps unique, capabilities of an innovation or entrepreneurial ecosystem that develop – opportunity provides the motivation and problem solving provides the foci for ecosystem development. But some barriers may inhibit growth and change, effectively blocking the expansion of value creation and the development of the ecosystem. Typical of the barriers to innovation ecosystem face are, for example:

- inertia of key actors- a failure, by influential actors, to move from traditional roles and established norms
- lack of supportive policy and the unresponsiveness of policy makers/administrators
- lack of a shared vision and lack of shared perception of opportunity in relation to risk
- lack of access to enabling resources, such as knowledge and finance[13].

Strengthening Innovation Systems in LLMICs

There has been an increasing emphasis on innovation and local knowledge generation in LLMICs. This recognises the role of innovation in economic growth and also the need for new knowledge and innovation to address many unique challenges in such areas as health and agriculture. The interest in innovation often combined with the long-standing emphasis on science and technology for development in what could seem a coherent approach to science, technology and innovation (STI). However, as awareness has grown of the diversity of innovation this 'bundling' into STI has increasingly been seen as (at least conceptually) limiting. Many types of innovation, such as organisational, business model and institutional innovation, may require no inputs from S&T, and many S&T-based innovations require complementary social and organisational innovations.

The key objective in promoting innovation in LLMICs has been economic growth, for which productivity growth and competitiveness are essential. It has also been recognised that the incorporation into processes and products (and also policies and organisation) of new technology and knowledge from developed countries often requires innovation for adaptation. The rise of disruptive new platform technologies such as digital technologies and biotechnology, with potential to make obsolete many capabilities that have been developed in LLMICs, and also to offer new pathways to address problems, adds another focus and horizon to the long path of capability accumulation for innovation.

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[11] Purposive design has been important for the development of specific organisations, technologies and sectors, overall innovation systems have evolved over many decades through a myriad of influences and policies unrelated to innovation.

[12] For example: Rabelo, R. J., Bernus, P., & Romero, D. (2015). Innovation ecosystems: A collaborative networks perspective. In Working conference on virtual enterprises (pp. 323–336). Cham: Springer; Adner, R., 2012. *The wide lens: A new strategy for innovation*. Penguin UK; Talmar, M., Walrave, B., Podoynitsyna, K.S., Holmström, J. and Romme, A.G.L., 2020. Mapping, analyzing and designing innovation ecosystems: The Ecosystem Pie Model. *Long Range Planning*, *53*(4); Dedehayir, O., Mäkinen, S.J. and Ortt, J.R., 2018. Roles during innovation ecosystem genesis: A literature review. *Technological Forecasting and Social Change*,*136*, pp.18-29; De Bernardi, D. Azucar, 2020. Innovation in Food Ecosystems, Contributions to Management Science, Springer Nature Switzerland AG.

[13] Based on Almpanopoulou, A., Ritala, P., & Blomqvist, K. (2019). Innovation ecosystem emergence barriers: Institutional perspective. In Proceedings of the 52nd Hawaii International Conference on System Sciences.

In the OECD economies the key locus of innovation has been in private firms in the manufacturing sector. One of the challenges in applying innovation systems frameworks developed in OECD countries to the LLMICs is the major differences in economic structure in LLMICs:

".. *research on innovation systems in LLMICs has found that the nature of innovative outputs is mostly informal; most of the innovations take place in informal settings and through informal interactions, which have until recently been largely absent from the research agenda on innovation systems.*"[14]

Innovation systems in LLMICs are typically characterised by[15]:

- Links between key actors are weak
- In particular, there are typically little feedback and feed forward between (potential) users and producers of innovation
- There is a lack of qualified human capital at all levels
- The policies and mechanisms to support innovation are weak and the broad institutional context does not provide adequate incentives for nor support for innovation
- There is low absorptive capacity in firms
- Links between firms and research organisations are constrained by the lack of absorptive capacity in potential users and a lack of understanding of (potential) user needs and a lack of integrated multidisciplinary knowledge in research organisations
- The capacities and structures for financing innovation are inadequate.

Our (limited but growing) knowledge of innovation processes and of innovation system performance and development suggests several implications for LLMICs:

- There are no blueprints that provide a ready guide to developing innovation systems, as the balance of goals, the prior history and the institutional context shape the approach.
- Strong innovation systems will evolve slowly.
- As innovation ecosystems involve interaction among often very different types of stakeholder, the social and cultural dimensions of those interactions may be complex and require (and build) social learning and the development of social capital.
- Collaborating, taking risks and learning, in a context of uncertainty, are essential for innovation and for developing innovation capability. While economic opportunity usually provides the incentive for embarking on that process, this is particularly difficult for groups with low access to resources and social power and in a low-trust society.
- The wider institutional context strongly influences to incentive to innovate and access to resources.
- Coordination within an innovation ecosystem requires a form of local institution, which is likely to evolve as the ecosystem develops.
- While mobilising knowledge in the process of problem solving is central to innovation, the framing and expression of problems is as important. But in many cases the engagement of knowledge demand and supply, faces organisational and cultural challenges.
- While many types of knowledge beyond S&T may be required for innovation, much of the knowledge to solve a problem may already exists and not require new research to generate new knowledge.
- Minor innovations involving the adaptation of technologies to, for example, use local inputs, may have major impacts on welfare.

Beyond Economic Growth -Inclusive Innovation and the Direction of Innovation System Evolution

In OECD countries, the potential role of innovation in more directly addressing a range of social goals, beyond economic growth, has been an increasing focus for policy research and policy development. Among the most important of these 'new' goals has been environmental sustainability, but a range of

[14] Sida, 2019 Position Paper. Support to Innovation and Innovation Systems within the Framework of Swedish Research Cooperation – taking stock, lessons learned and the way ahead. Sida. p.9

[15] Sida, 2019. Position Paper. Support to Innovation and Innovation Systems within the Framework of Swedish Research Cooperation – taking stock, lessons learned and the way ahead. Sida. Stockholm, Sweden; Kraemer-Mbula, Erika and Watu Wamae (eds), Innovation and the Development Agenda, OECD and IDRC, Ottawa, 2010; Rath, A. et al 2012a;

other social goals, such as the reduction of inequality, have been promoted. The interest in new goals for innovation implies new approaches to the governance and ongoing evolution of innovation systems.

A focus of much recent research on innovation and innovation systems in LLMICs has been the potential for innovation to address objectives of social inclusion and more recently sustainability and responding to climate change. There have been many different approaches that aim to conceptualise the relationships between innovation and social inclusion, including the 'appropriate technology' movement of the 1970s[16]. Some approaches to innovation for social inclusion focus on the development and access by marginal groups to products and services relevant to their needs, while others focus on the involvement of excluded groups in innovation processes/ecosystems and through that experience improved capacity to participate in innovation. The extent to which LLMICs have begun to develop new goals for innovation and new approaches to innovation system governance is discussed further in the following section.

Promoting inclusive innovation

Recognising that growth paths in many LMICs have done little to address (and have often contributed to) persistent inequality and have been environmentally unsustainable, many development organisations have sought to emphasise equality, inclusion and environmental sustainability objectives in their development support[17]. While mission-oriented innovation policy might pursue these objectives at the macro level, one expression of this intent at the meso level is the recent focus on 'inclusive innovation'- a term that encompasses a range of definitions and frameworks. Hoffecker (2021) defines inclusive innovation in terms of:

"..a collaborative and co-creative, multi-stakeholder approach to innovation that prioritizes the agency and leadership of groups that are traditionally excluded from innovation activities and from the benefits of economic development. Inclusive innovation processes rely upon the meaningful participation of people who are experiencing the challenges that the innovation process is intended to address, and produce results that benefit those who are disadvantaged by the existing opportunity structures in their respective contexts."[18]

From the several case studies of inclusive innovation she identifies a set of generic activities and processes that can be effective in changing the local context which, with ongoing support activities, can trigger processes of social learning, social capital strengthening, collective cognition, and consensus formation. These can then act as causal mechanisms generating intermediate outcomes that can lead to technical, organizational, and institutional system innovation. This is the basis for a 'middle-range' model of inclusive innovation processes: Figure 2.2.

Hoffecker, (2021) discusses the importance of facilitation skills and of adaptive management skills in the teams facilitating inclusive innovation, particularly: "*the capacity of project teams to learn in real time and to translate and share that learning with different types of stakeholders engaged in the project… [in a context] in which stakeholders are often positioned with widely varying levels of privilege and access to information and resources, the ability of a project team to effectively translate knowledge and lessons learned in a timely way is essential."*[19] Consequently, she is highly critical of ex ante logframe and work-plan driven project planning that constrain the level of flexibility required for adaptive management.

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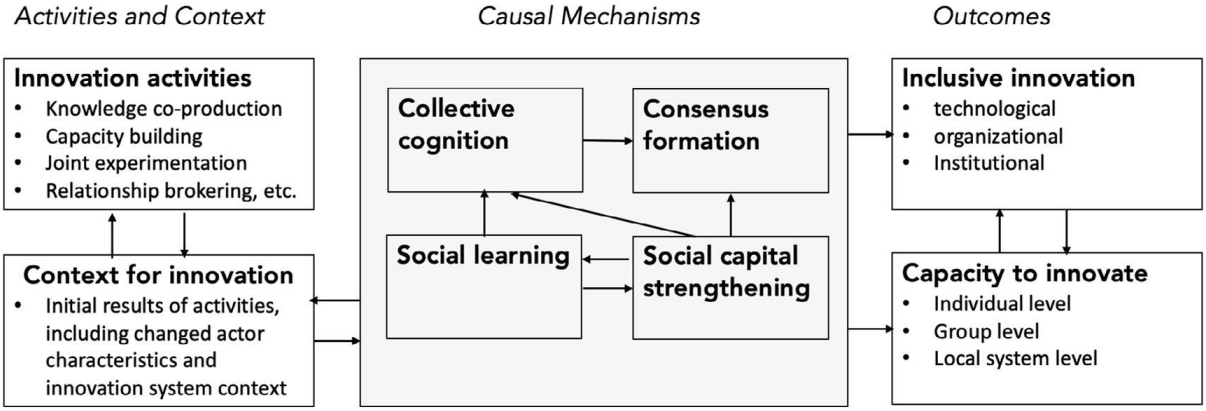
[16] See for example: Bortagaray, I. and Gras, N., 2014. Science, Technology, and Innovation Policies for Inclusive Development: Shifting Trends in South America. In *Science, technology and innovation policies for development* (pp. 255-285). Springer, Cham.

[17] Hoffecker, E., 2021. Understanding inclusive innovation processes in agricultural systems: A middle-range conceptual model. World Development, 140; Pansera, M., & Owen, R. ,2018. Framing inclusive innovation within the discourse of development: Insights from case studies in India. Research Policy, 47(1); Chataway, J., Hanlin, R., & Kaplinsky, R.,2014. Inclusive innovation: An architecture for policy development. Innovation and Development, 4(1):33–54; George, G., McGahan, A. M., & Prabhu, J.,2012. Innovation for inclusive growth: Towards a theoretical framework and research agenda. Journal of Management Studies, 49(4):661–683.

[18] Hoffecker, E., 2021. Understanding inclusive innovation processes in agricultural systems: A middle-range conceptual model. World Development, 140. p.5.In OECD (2015) an inclusive innovation is one that provides opportunities, in the sense of affordable access to quality goods and services, for improved livelihoods to marginal groups, and does not address the issue of inclusion in the innovation process that develops or produces the good or service. OECD, 2015. Innovation Policies for Inclusive Development. Paris. OECD

[19] Hoffecker, E., 2021. Understanding inclusive innovation processes in agricultural systems: A middle-range conceptual model. World Development, 140. p.13

Figure 2.2 Middle-range model of inclusive innovation processes at the level of context, mechanisms, and outcomes[20]



[20] Hoffecker, E., 2021. Understanding inclusive innovation processes in agricultural systems: A middle-range conceptual model. World Development, 140. p.11

3. Innovation and International Development Assistance

Innovation Ecosystem Strengthening Initiatives

Development agencies have long supported the potential of science and technology to address problems and create opportunities for value creation. One aspect of that support has been long standing initiatives to develop S&T capability (in terms of organisations and human resources) in developing countries. More recently, that scope of that support has widened to explicitly include the development of innovation capability and hence the catch-all of STI. Initially the focus on STI support was on the supply-side – the generation of knowledge – but long experience with the limited success of 'technology transfer' projects, led to a re-focusing on, or at least inclusion of, the demand side[21]. Influenced by the innovation system frameworks that now shape innovation policy in the OECD countries, the frameworks for development assistance in STI now also take a systems approach.

Promoting innovation for and in LLMICs has been increasingly incorporated into development assistance programs over the last 30 years, or more. A systems perspective to innovation promotion and particularly a concern with strengthening innovation systems in LLMICs is more recent. A pioneer in that approach was IDRC, which has had a long-standing emphasis on developing local capabilities for innovation. The systems perspective on innovation has been paralleled by a systems or structuralist perspective on development in general:

"*Systemic approaches to development have, over the last decade, gone from a niche concern to what is arguably a paradigm shift, in discourse at least…..Fundamentally, the consensus which has emerged relates to the objective of ensuring that approaches to addressing development goals including poverty reduction, improved nutrition, and gender equity, achieve … impacts at scale*."[22]

In the Whistler Principles the G7 have an expressed commitment to promoting innovation for inclusive and sustainable development, along with overall economic growth – see Table 3.1.

***Table 3.1 The Whistler Principles to Accelerate Innovation for Development Impact*[23]**

Promote inclusive innovation, with a focus on supporting the poorest and most vulnerable, such as women and adolescent girls and persons with disabilities, to have lasting development impact;

Use evidence, including disaggregated data, to drive decision-making to improve impact and cost-effectiveness by developing clear metrics early on and measuring progress against milestones on an ongoing basis to help identify the most effective innovations and the remaining gaps;

Invest in locally-driven solutions and support and encourage local innovators and their partners in developing countries, including by sharing talent and resources from global networks with them;

Facilitate collaboration and co-creation across public, private, and civil society sectors and coordinate the application of innovations to leverage resources from all, and share data, standards, results and learning widely;

Identify scalable solutions, including technologies, that demonstrate high potential to achieve and sustain significant impact and cost-effectiveness, and open the potential to reach millions of people in need in developing countries;

Integrate proven innovations into organisations' larger programming by removing the internal and external barriers to using these solutions in current and future projects, and support the acceleration of growth and impact of proven innovations.

Take intelligent risks by experimenting and using rigorous data and investing once initial steps yield evidence of the demonstrated impact and financial viability through proof of concept;

Seize opportunities to learn quickly, iterate and ensure the impact of promising innovations before scaling them up by also acknowledging failure and inefficiencies.

As development agencies had also been seeking new approaches that would be more effective in addressing complex problems, innovation quickly became a pervasive aspect of programs. This was

[21] Bourguignon, F. and Platteau, J. P. (2017). Does aid availability affect effectiveness in reducing poverty? A review article. World Development, 90, 6–16

[22] Taylor, B. 2016. New Approaches to Old Problems: Systemic Change as a Unifying Objective. Enterprise Development and Microfinance 27(1).

[23] Available at https://www.international.gc.ca/world-monde/international_relations-relations_internationales/g7/documents/2018-05-31-whistler-development-developpement.aspx?lang=eng.

expressed in a diverse range of new initiatives and funds for capacity building across the full range of agencies' scope. For example, support for innovation is seen by Sida *as:*

> "..*an important tool to contribute to the … overarching goal of "poverty reduction and sustainable development". Sida views research cooperation and development of innovation capability as key and strategic to sustainable development, addressing environmental, social, and economic challenges in low- and lower middle-income countries and regions*"[24]

More broadly, developing innovation capability is seen as one aspect of developing greater agency:

> *".. what really matters .. is the capacity of citizens to make and shape their own world..-A society rich in agency will …. be full of capacities to generate new ideas – and not just depend on ones that come from leaders or elites. They may be very small ideas, as well as big ones. Many may be imported or adopted from elsewhere (as Jane Jacobs pointed out, the mark of the most prosperous places is that they are brilliant at importing as well as exporting ideas)."*[25]

A recent OECD review of member country support for innovation in their development assistance provides a useful overview of the increased emphasis on innovation:

> *"At its best, the innovation work DAC donors have led and supported involves the fusion of new technologies and technical advances with new business models and organisational approaches, as well as efforts to reform and transform institutions, norms and political contexts…..There are new methods and tools, new teams and departments, new collaborations and partnerships, and new principles and ways of working. There is also a growing realisation that the sector needs to do more than just ask for innovation: it needs to roll up its sleeves and start doing innovation..[Among development agencies there have been] multiple directions, ideas and approaches to innovation …. Innovation can be about transformational or incremental change; it can focus on specific types of technology or on changes in behaviours and attitudes; and it can be about early-stage experiments or wider systemic transformation. It can focus on specific challenges within an area of development or humanitarian work (e.g. health) or it can be more generally in support of changing the way the sector as a whole works in response to a given challenge."*[26]

As will be discussed further in the following section two major foci for innovation-oriented development assistance have been the strengthening of entrepreneurial ecosystems and inclusive innovation ecosystems. A recent framing of innovation capability development has been in relation to the Sustainable Development Goals (SDGs).

The influence of the systemic approach to innovation has also been channelled, through major reports and reviews of national STI systems, by a number of multilateral organisations, particularly the World Bank, UNESCO and the OECD[27]. Schwachula et al, (2014), argue that the STI frameworks and advice of the World Bank, OECD and UNESCO – and the innovations systems perspective more generally - overemphasise economic growth relative to inclusion and environmental sustainability goals, the formal relative to the informal economy and actors, the role of firms in innovation relative to the role of other organisations, and the role of technological relative to non-technological innovation.

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[24] Sida, 2019. Position Paper. Support to Innovation and Innovation Systems within the Framework of Swedish Research Cooperation – taking stock, lessons learned and the way ahead. Sida. For a similar view of Finnish support see: Hooli, L.J. and Jauhiainen, J.S., 2017, Development aid 2.0—Towards innovation-centric development co-operation: The case of Finland in Southern Africa. In *2017 IST-Africa Week Conference* pp. 1-9

[25] Mulgan, G., 2016. [The path ahead: development as innovation' in Ramalingam, B. and Bound, K. (Eds) 2016. Innovation for International Development - Navigating the Paths and Pitfalls. NESTA. P.225-6

[26] OECD, 2020. The Development Dimension. Innovation for Development Impact. Lessons from the OECD Development Assistance Committee. Paris: OECD. Pp 3,12,27-8.

[27] Schwachula, A., Vila Seoane, M. & Hornidge, A-K, 2014: Science, technology and innovation in the context of development: An overview of concepts and corresponding policies recommended by international organisations, ZEF Working Paper Series, No. 132, University of Bonn, Center for Development Research (ZEF), Bonn

The International Development Innovation Alliance (IDIA)

A review of the experience of 13 members of The International Development Innovation Alliance (IDIA) [28]. - an alliance of 15 major bilateral and multilateral aid agencies and foundations which identify ecosystem strengthening as a key goal - provides a useful, if necessarily partial, view of the approach of leading development agencies to innovation ecosystems strengthening programs. A review of IDIA members' collective experience in projects that aim to strengthen innovation ecosystems characterised three approaches, along a spectrum:

1. Entrepreneurial support – placing the innovator as the key actor and addressing gaps in support and resources to support the entrepreneur;
2. Innovation processes – addressing the capacities of the overall ecosystem to translate ideas into solutions and then to scale these;
3. Mission-driven approaches – developing a shared mission among ecosystem actors.

The review identifies nine foci types of goal for ecosystem strengthening programs and Figure 3.1 shows the extent to which each of the IDIA member's programs include that goal. This assessment suggests that 'access to finance' and 'networking and productive relationships' were goals pursued in almost all interventions, whereas promoting a 'culture of innovation' and 'equitable and inclusive governance and participation' were goals in a half or less of the programs.

Figure3.1 Mapping IDIA Member Interventions against the Ecosystem Strengthening Goals[29]

	1 Informed Human Capital	2 Accessibility of Finance	3 Supportive Markets & Infrastructure	4 Enabling Policy & Regulation	5 Culture of Innovation	6 Networking & Productive Relationships	7 Equitable & Inclusive Governance & Participation	8 Smoother Pathways to Scale	9 Mobilise Around a Development Challenge
BMGF	•	•	•	•		•	•	•	•
DFAT	•	•				•		•	
Dutch MoFA	•	•	•	•	•	•			•
FCDO	•	•	•	•		•	•		
GCC	•	•	•	•		•	•	•	•
GIF		•	•	•	•	•		•	
GAC	•	•	•	•		•	•	•	•
GIZ	•	•	•	•	•	•			•
Rockefeller	•	•	•		•	•	•	•	•
Sida		+			+	+	+		
Skoll		+		+	+	+		+	
UNICEF	•	•	•	•		•			•
USAID	•	•	•	•	•	•		•	•

Key: • Confirmed goal + Agency perspective to be confirmed

The compilation of information on 40 programs of IDIA members that address innovation ecosystem strengthening also provides some indication of the issue or sectoral focus of these programs: about 20 per cent were multisectoral and generally aimed at a macro level and a similar proportion were focused on entrepreneurship. The most common sectoral focus was health, which was an objective in about 25per cent of programs. Other sector or issue foci in order of frequency were: energy, agriculture, education, water quality, women's empowerment, and digital technology application.

The scope of the ecosystems to be strengthened were inevitably shaped by the scope of the aid project (and were often essentially sectoral and/or regional), and the boundaries were subjective.

For IDIA members the type of innovation that is of interest is that which has 'transformative ability' and can provide 'path-breaking improvements'- which inevitably raises the issue of scaling innovations. According to the review, while IDIA members have increasingly recognised the importance of

[28] Results for Development and IDIA Strengthening Innovation Ecosystems. Background Paper. 11 May 2021 Version. IDIA

[29] IDIA, 2021, p59

ecosystem-level interventions, they have begun to develop facilitation approaches that focus on helping different ecosystem actors connect in order to define problems and solutions themselves and to advocate for more inclusive ecosystem approaches. These approaches are related to an increasing awareness that:

> *"..it takes an ecosystem to scale an innovation, and that many more actors play a crucial role in achieving that scale than the innovator alone. Recognising this, many development agencies have shifted their focus from direct support to innovators to expand the focus of strengthening efforts to include other key actors such as academic institutions, governments and the private sector with a view to optimizing the role that each of these actors played in enabling the development of local innovation and strengthening the means to take a great idea to scale."*[30]

Mission-driven approaches reflect an urgency in addressing complex problems but also a view that a 'hot house' context can be more effective in driving change:

> "*Mission-driven approaches offer the ability to create a shared sense of purpose and identity among otherwise fragmented or distrusting ecosystem actors …. Buoyed by the spirit of common direction, ecosystem actors may also be more open to codesigning and testing new forms of partnership and collaboration, some of which may then cement longer-term, productive relationships that extend well beyond the timeframe of the mission that brought them together*"[31]

Drawing on the experience of IDIA members the review proposes a set of 'guiding principles' for ecosystem strengthening initiatives – Table 3.2

Table 3.2 Guiding Principles for Designing / Implementing Ecosystem Strengthening Initiatives[32]

1. **Recognise the diversity of actors** who play a role in the innovation and scaling process, and ensure any intervention is contributing to strengthening the connectivity and trust among these actors.
2. Utilise political economy analysis tools to **understand inequities within the ecosystem** to do with power, resources, norms and values, and integrate ways to redress these inequalities within ecosystem strengthening initiatives.
3. **Engage governments at all levels** from the very beginning to maximize the depth, breadth and sustainability of any impact brought about through ecosystem strengthening initiatives.
4. Consider how to **engage, learn from and help influence smaller, local level players and processes alongside the larger actors** and institutions, particularly where they have potential to deliver greater impact through collective organization.
5. Ensure that interventions **prioritise local ownership of innovation processes** in order to support sustainability, and be cognisant that it may be more appropriate to help ready local actors in that system to drive change rather than going in to try and 'fix' problems that have been identified.
6. **Focus on one (or a subset of) ecosystem challenges**, rather than trying to tackle too many issues at once.
7. Recognise that while ecosystem strengthening interventions are typically designed to promote incremental improvements, they can also **potentially be vehicles for driving larger systems innovation.**
8. **Embed feedback loops and agile monitoring and evaluation** mechanisms into any collaborative approach to capture learning and iterate models accordingly to ensure the benefits of the intervention are distributed in an inclusive manner.

There may often be conflicts among these principles, related to differences in formal and informal government policy, challenges of inclusion and realities of social and economic power.

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[30] Results for Development and IDIA Strengthening Innovation Ecosystems. Background Paper. 11 May 2021 Version. IDIA p11

[31] Results for Development and IDIA Strengthening Innovation Ecosystems. Background Paper. 11 May 2021 Version. IDIA p12

[32] Results for Development and IDIA Strengthening Innovation Ecosystems. Background Paper. 11 May 2021 Version. IDIA. p14

While the review of IDIA member experience finds that prior to undertaking ecosystem strengthening initiatives an agency should 'understand the development goals in a country' or region, and 'understand government priorities for innovation', there is no discussion of the possibility that inclusion and empowerment of some groups may not be government priorities.

In reviewing the main objectives of ecosystem strengthening initiatives by aid agencies, the review identifies nine goals, each of which is discussed at length in the review[33]. Table 3.3 lists these goals and summarises the key challenges that IDIA members have experienced in pursuing them.

Table 3.3 Ecosystem Goals and Related Challenges

Ecosystem Goal	Key Challenges
1. Build informed human capital	● Limitations in skills, knowledge, or knowledge sharing among partners ● Lack of diversity in talent pool, or structural, financial support to incentivise pursuing innovation
2. Ensure accessibility of finance	● Slow growth in the diversity of financing mechanisms ● Limited amounts of appropriate financing to match innovation and scaling needs ● Investment return uncertainty and risk-aversion ● Bias/discrimination funding allocation ● Dominant funding practices are ill-suited to support systems innovation
3. Establish supportive markets and infrastructure	● Inadequate and unreliable infrastructure ● Barriers to market entry and innovation uptake
4. Create enabling policies and regulations	● Lack of clarity of the role government should play or unsuitable policies to encourage innovation, or siloed approaches
5. Nurture a culture supportive of innovation across actors	● Culture of innovation/mindset is not well understood or narrowly focused on technology ● Ecosystem is fragmented or actors siloed ● Short-term views prevail over long-term planning
6. Support networking assets that enable productive ecosystem relationships	● Low awareness / recognition of operating as an ecosystem ● Confusion over Intellectual Property Rights ● Externally designed networking interventions that undermine ecosystem productivity and inclusion
7. Ensure equitable and inclusive ecosystem governance & participation	● Marginalized groups remain underrepresented in talent pool ● Strengthening efforts do not address inequalities and can risk exacerbating them
8. Create smoother pathways to scale for specific innovations	● Lack of incentives to seek out new innovations / pathways / coordination ● Strong emphasis on 'supply' with limited emphasis on 'demand'
9. Mobilize a collective ecosystem to address a particular issue or development challenge	● Lack of visibility, coordination or alignment among actors ● Ensure diversity and inclusion of important actors ● Centring actors around addressing complex or controversial issues

Sida's Role in Supporting Innovation and Innovation System Strengthening- a Case Study

Sida has supported innovation and innovation system development since 2003, taking a systems approach and focusing on promoting enabling environments for innovation, rather than promoting

[33] Results for Development and IDIA Strengthening Innovation Ecosystems. Background Paper. 11 May 2021 Version. IDIA p22

individual innovations. Sida see support for innovation system development as critical for pursuing an overall goal of poverty reduction and sustainable development, as elaborated for example in the SDGs. Specific projects in low- and lower middle-income countries (LLMICs) address such challenges as poverty, health, productivity, competitiveness, economic diversification, food security, climate change and governance. Their focus is on innovations and innovation processes that have the potential to be transformative:

> *"Transformative innovation is about empowerment and change in society, where innovation is viewed as a means to increase social sustainability …. Transformative innovation should broaden the flow of ideas, increase the diversity of innovators, and contribute to a more sustainable transformation to address current social challenges, meet global sustainability goals and obtain sustainable growth. Inclusive innovation refers to a development process where marginalized groups take part in and benefit from the process."*[34]

Table 3.3 summarises the four foci for intervention and the range of mechanisms used by Sida. A great deal of innovation in LLMICs is in the informal sector, where the policy regime of the wider national innovation system has little sway. In this and often also in the formal sector Sida's experience has found that innovation systems are weak, due to:

- weak social and market-based interactions among actors due to a lack of trust and shared interests
- low innovation capacity due to a low level of human capital
- limited financial resources and severe constraints on access to finance by marginal groups
- a broader organisational and institutional context that provides little support for innovation.

Table 3.4 Foci for Intervention[35]

Focus of challenge for intervention	Possible mechanisms
Promote interaction among actors and building trust and a shared innovation system strengthening agenda	• Involve users in co-production innovation processes • Developing intermediaries to 'translate' between users and knowledge providers • Developing 'neutral spaces' for interaction, trust building and evolving a shared agenda • Promoting improved human and financial resources with clusters
Capacity to innovate	• Education and skilling of human resources • Strengthening the absorptive capacity of firms • Developing research capacity in research organisations and universities
Finance for investment in eg education and training, new ventures, critical infrastructure	• Access to risk finance for new ventures to enable proof of concept and early stage scaling • Finance for education and training and key infrastructure for enabling linkage to information, markets, power etc.
Support organisations and institutions	• Encourage the development of effective regulation and policy • Contribute to policy learning through policy-relevant research • Encourage a commitment to evidence-informed policy.

Table 3.4 summarises the three strategic objectives of Sida's innovation-related programs and the modalities of initiatives pursuing these objectives. The most frequently used modalities are those involving research collaboration and almost all of modalities centre on or involve local universities. The 2019 Sida places a particular stress on what they term 'transformative innovation', the local generation of new knowledge and scaling innovation, the role of universities and, hence, on 'triple helix' models of innovation system support. Universities are seen as having the potential to be key actors in innovation processes, as providers of:

[34] Sida, 2019. Support to Innovation and Innovation Systems within the Framework of Swedish Research Cooperation- taking stock, lessons learned and the way ahead. Position Paper. Sida. p.6
[35] Summary from Sida, 2019. Support to Innovation and Innovation Systems within the Framework of Swedish Research Cooperation- taking stock, lessons learned and the way ahead. Position Paper. Sida. p.6-9.

- human capital with adequate training,
- scientifically validated knowledge, including for evidence-based policy, through (multidisciplinary) research,
- relatively neutral platforms for interaction between researchers and the surrounding society.

Table 3.4 Objectives and Modalities of Sida's Innovation-Related Programs[36]

Sida Strategic Objective	Modality	No. Programs*
More interfaces, networks and cooperation established between actors from research institutions, the business sector, public authorities and civil society.	Innovation clusters involving stakeholders from academia, public authorities, society and the private sector	4
	Innovation Hubs at universities for interaction with society	6
	Research collaboration with private sector	18
	Research collaboration with society, eg social innovation in health	19
	Research collaboration with decision-makers	20
Improved conditions for researchers to develop innovative ideas with the potential to contribute to the emergence of new products and services that contribute to poverty reduction and a sustainable society.	Strengthening capacity of actors in the innovation system	3
	Innovation networks	3
	Funding of innovation	6
	Structures to enable innovation	2
	Monitoring of innovation	1
	Innovation research	3
Reinforcement of the role of universities and their contribution to innovation processes and systems.	PhD training in innovation	2
	MSc training in innovation	2
	Innovation Hubs to increase university's role	6
	Involving students in innovation activities	4
	Specific research infrastructures to stimulate innovation	2
	Supporting research-based innovations	6

* Number of Sida programs in which this modality is used.

While Sida's approach to supporting innovation systems emphasises the central role of universities, its experience is that the outcomes under this approach have been mixed. The development of linkages between universities and potential users in the formal and informal sector has often been very slow. The 2019 Position Paper notes that uptake of university research by policy makers in LLMICs has been particularly limited. The Paper emphasises the importance of multidisciplinary research and of the participation of diverse stakeholders in innovation processes. But with regard to the challenge of poor linkages, the paper recognises the need for significant changes in the capabilities, organisation and culture of universities (and potential users)[37]. It also notes that active facilitation to promote the development of capabilities, structures (eg 'innovation hubs') and links will often be necessary.

[36] Sida, 2019. Support to Innovation and Innovation Systems within the Framework of Swedish Research Cooperation- taking stock, lessons learned and the way ahead. Position Paper. Sida. p.14-22, 34-5.

[37] There is now an extensive literature on models for a developmental university in LLMICs, for example: Krishna, V.V. (Ed) Universities in the National Innovation Systems: Experiences from the Asia-Pacific. 2019. Routledge; Arocena, R., Göransson, B. and Sutz, J., 2017. Developmental universities in inclusive innovation systems: Alternatives for knowledge democratization in the global south. Springer; Brundenius, C., Lundvall, B.Å. and Sutz, J., 2009. The role of universities in innovation systems in developing countries: developmental university systems–

Sida's experience is that understanding of innovation in general and of inclusive and transformative innovation in particular, among university leaders, policy makers and research granting organisations, is poor. This leads to a lack of effective support and misaligned policies.

Based on its experience of programs to support innovation in LLMICs Sida's 2019 Position Paper recommends, a range of interventions to address the challenges that continue to limit outcomes – Table 3.5.

Table 3.5 Recommendations for Interventions in Future Sida Programs[38]

Broad Challenge	Focus for Interventions
Promote interaction and linkages among actors	• An early interaction between researchers and stakeholders in society must be promoted, such as the private sector, public sector, and social actors including civil society organisations.
	• A systematic approach to interaction between research institutions and the surrounding society should be developed, possibly through adapted policies related to innovation.
	• Interaction and/or collaboration between actors from different disciplines and sectors through granting mechanisms should be promoted.
	• Improved ways of engaging decision-makers can be further developed, possibly through enhanced experience-sharing amongst Sida-funded organizations.
	• Embedded research and implementation research can be further promoted.
	• An evaluation of factors influencing the development of triple-helix innovation clusters would support future cluster set-ups.
	• Development of innovation hubs is crucial for increased innovation generated at the research institutions, as the hubs are a gateway between the university and the surrounding society, and provide the capacity to stimulate and drive innovation.
Capacity to Innovate	• Institutional innovation capacity starts by training individuals, for example through the training of innovation managers. Increased training at the research institutions is key to a sustainable change. General innovation training of university leadership contributes to the understanding of innovation and is needed to institutionalise innovation efforts.
	• A regional network of innovation managers would contribute to continuous training and experience sharing.
	• Competence building in financing and monitoring of innovation projects shall be promoted at granting councils.
Financing structures	• Nationally or regionally based innovation funding agencies should be promoted.
	• An analysis of regulatory limitations and the identification of actors responsible for scaling of a particular innovation should be done early on, possibly integrated as a requirement in Sida-funded projects.
Structures, policies and mechanisms	• Monitoring of innovation at national and regional levels is crucial for policy making, and support may be increased in this area, especially to improve the quality of the data.
	• Incentives structures for researchers to engage in innovation and interaction with society should be developed.
	• Innovation research focusing on the local context is necessary for policy making related to innovation and shall be encouraged.

empirical, analytical and normative perspectives. In Handbook of Innovation Systems and Developing Countries. Edward Elgar Publishing.

[38] Sida, 2019. Support to Innovation and Innovation Systems within the Framework of Swedish Research Cooperation- taking stock, lessons learned and the way ahead. Position Paper. Sida. p.23-30.

Challenges for Innovation Support Programs

Evaluations of the experience of innovation support programs and particularly of programs that aim to strengthen innovation systems/ecosystems are limited, but some of the issues raised in recent reports are discussed below:

- **Innovation push** - Building a grassroots demand that provides a clear signal for innovation development is often slow and the signals ambiguous. A recent OECD review concluded that: " What is common across many of the strategic innovation approaches reviewed as part of the DAC peer learning exercise.. on innovation for development is that many are based on an implicit assumption of "innovation push" to developing countries, as opposed to "innovation facilitation" with and for actors in developing countries."[39]
- **Experiment not prescription** – while the systemic approach to innovation can lead to greater understanding, the application of those concepts does not lead to prescriptions for policy and is highly context-specific. Consequently, an experimental and learning approach to innovation capability development is essential[40].
- **Measuring intangibles** - As learning (of many types) and building social capital are key processes of innovation capability development, assessing progress in these dimensions is a critical aspect of evaluation[41].
- **Developing appropriate staff** – innovation support requires new skills and attitudes in local and expatriate staff, but, according to a recent OECD review: "Innovation has not yet convinced the majority of staff in any DAC member of its value. In some organisations, certain senior managers and frontline staff may support innovation, but there is a 'frozen middle' "[42]

[39] OECD, 2020. The Development Dimension. Innovation for Development Impact. Lessons from the OECD Development Assistance Committee. Paris: OECD. Pp 27-8.
[40] Rath et al, 2012a, p122
[41] Rath et al, 2012a, p123
[42] OECD, 2020. The Development Dimension. Innovation for Development Impact. Lessons from the OECD Development Assistance Committee. Paris: OECD. p.31

4. Case Studies of Innovation-Oriented Development Programs

Introduction

This section aims to characterise the forms of intervention that have been used by agencies with the objective of effecting innovation system change. To that end it applies a system stress (or failure) framework to characterise intervention targets and assess their rationales from this systems framework perspective.

Categorising innovation support programs

Several quite different approaches to innovation-oriented development programs have developed. Some of the major programs focus on stimulating the development of 'solutions' to identified problems in LLMICs. For example, USAID's Development Innovation Ventures, the Global Innovation Fund (GIF) (an international consortium of the UK, USA, Sweden and Australia, as well as the Omidyar Network) and the Grand Challenges of The Bill & Melinda Gates Foundation offer venture-type funding through competitive bidding processes. While there is certainly a role for inventions, such as new medicines or medical devices, that may address identified problems, as these initiatives do not address the development of the innovation ecosystem they are not discussed further here[43].
Below we characterise the six approaches that do aim to strengthen innovation systems. Case studies of the first five of these types of program are in Appendix 1.

- **Entrepreneurial Orientated programs**
  The key focus is entrepreneurial support. The logic is that entrepreneurs and their business are the innovators that launch and scale new products and services in the market. These programs target gaps and resources needed for entrepreneurship, as satisfying entrepreneurs' needs can drive innovation. This includes strengthening capabilities and skills, financial resources and infrastructure needed for innovation. It also includes addressing missing or ineffective dimensions of the entrepreneurial ecosystem. This might concern missing actors such as venture capital and or weaknesses in the business operating environment such as regulation, legal frameworks and incentives. Capabilities need to commercialise new ideas are often a prominent feature of these programs.
  Impact vision: Entrepreneurship as a foundation of broader social and economic growth

- **Innovation process orientated programs**
  The key focus is on helping different actors realise and fulfil their role along various stages of the innovation processes across the innovation system. The logic is that innovation emerges from the interaction of producers and users of knowledge and ideas and that this process needs to be enabled by capabilities, communication channels and interaction opportunities, and by institutional and policy setting that incentivise and support this. These programs target partnership development, university industry relationships, innovation platforms and hubs, the translation of ideas into use, as well as institutional and policy considerations that support interactive innovation processes (for example professional reward systems in universities, or policy instruments that encourage university industry collaboration).
  Impact vision: Supporting the capacity of the innovation systems as a foundation for broader social and economic growth.

- **Policy orientated programs**
  The key focus is strengthening innovation policy formulation and policy learning. The logic is that policy settings play a critical role in enabling the functioning of the innovation system, supporting the development of innovation capability and capacity, as well as shaping the direction of innovation through the selection of priorities aligned to national development aspirations. These programs target both policy research and a range of policy formulation tasks and capability. This can include diagnostics studies and innovation policy reviews to targeted policy development (for example regulation for biotechnology or intellectual policy), evaluation and

[43] There is increasing recognition that not only do such 'innovation challenges' often do little to strengthen innovation capabilities and innovation systems in LLMICs, but the expectations that the 'solutions' will diffuse widely (ie scale-up) have not been met, see: Ramalingam, B. and Bound, K. (Eds) 2016. Innovation for International Development - Navigating the Paths and Pitfalls. NESTA

impact assessments of policy interventions. It also targets policy formulation capability and innovation policy coordination through the development or strengthening of innovation councils and similar agencies. More recently, these programs have targeted helping national governments design consultation and foresighting processes to reframe innovation policy towards the UN' SDGs.
Impact vision: effective innovation policy settings as a foundation for broader social and economic growth, but increasingly targeting better alignment with inclusive and sustainable growth and development strategies.

- **Multi-level / portfolio orientated programs**
  The key focus is integrating different forms of innovation support across different scales of the innovation system. The logic is that innovation capacity is systemic and requires issues of entrepreneurship, partnership and interaction, institutional and policy development to be tackled in an integrated fashion with strong feed-back loops and iteration. These programs target different dimensions of innovation strengthening usually around bounded themes such as commercialisation, research translation or industry specific issues. Program components can include capacity building, grant schemes, venture capital challenge programs, policy research, evaluation and strategy development. The use of practical innovation use cases as a way of informing policy and institutional reform is a common characteristic.
  Impact vision: Systemic development of innovation capacity as a foundation for broader social and economic growth, but can be targeted at specific development impacts such as women's health, resilience through the targeting of bounded themes.

- **Deploying new platform technology-oriented programs**
  The key focus is building technological capability to enable the deployment of emerging platform technologies. The logic is that new platform technology can have pervasive effects across the economy, but that this requires new technological capacities in the realm of both R&D and entrepreneurship as a suite of policies and regulations to enable its use and to avoid perverse or negative social and environmental consequences of its use. These programs focus on building technological capability on a specific new platform technology in research business and policy organisations. Programs may be focused on a specific industrial sector, such as agricultural biotechnology, or may be across industry focused, such as digital transformation. The balance between building R&D capability, entrepreneurial capability to deploy the new technology, and the development of enabling policies varies with the emphasise often shifting over time.
  Impact logic: Building technological capability can be targeted in the service of defined social, economic and environment objectives

- **Mission oriented programs**
  The key focus is to marshal innovation capabilities, resources and actors around clearly defined and bounded challenges of high relevance to societal scale development aspiration. The logic is that existing patterns of innovation capacity, action and policy are not well aligned to the resolution of these challenges (plastic waste, climate change, water pollution) and that by focusing attention on defined challenges, technical, institutional and social solutions can be mobilised to address them. Solutions are often systemic in nature requiring a combination of system and component innovation, as well as supporting policy shifts. These programs often take the form of a thematic hub or platform or some other program device to coordinate the activities of different innovation actors and stakeholders. This often involves mobilising and adapting existing technology and expertise. It may often involve enrolling communities and informal sector players that can provide models of social innovation and solutions.
  Impact vision: Building capacity for mission directed innovation can be targeted in the service of defined social, economic and environment objectives.

In Table 4.1 we summarise the characteristics of these programs in terms of purpose, scope and intervention targets. In that table we also indicate the detailed case study of that form of policy program which we have set out in Appendix 1, which are:

1. Innovation Process Support- Sida's Innovation Systems Cluster Program in East Africa
2. Entrepreneurial Ecosystem Development - The Scaling Frontier Innovation (SFI) Program
3. Developing Capabilities in Platform Technologies – BioEARN and Bio-Innovate in East Africa

4. Innovation Policy Support Programs - Policy Support Programs of Multilateral Agencies
5. Multi-level/ Portfolio Programs - the Inter-America Development Bank.

In Table 4.2 we relate these major program types, which typically include a range of intervention targets, to the categories of innovation system stress or failure[44]. It is clear that these programs address a range of innovation system limitations.

In Section 3, we included a figure from the recent IDIA report summarising the intervention goals of the programs, that aim to strengthen innovation ecosystems, of the IDIA members. The majority of the support programs discussed in the IDIA report, and considered as 'innovation ecosystem strengthening' interventions, were relatively narrowly cast. Those programs that focused on supporting specific innovations (eg innovation challenge schemes, which might source 'innovations' from anywhere) or that supported entrepreneurship development (including entrepreneurial ecosystem development) accounted for over half of all interventions listed in the report and these were often the largest programs. Hence, the experience in ecosystem strengthening interventions is more limited than the IDIA report might suggest. In Table 4.2 we relate these main intervention goals to the categories of innovation system stress or failure. While this identification of the relationship between the intervention goals of IDIA member programs and types of systems stress should be regarded as indicative, it is clear that addressing specific goals often involves addressing a range of system stresses.

[44] This innovation system failure framework draws on Woolthuis, R.K., Lankhuizen, M. and Gilsing, V., 2005. A system failure framework for innovation policy design. *Technovation*, *25*(6), pp.609-619.

Table 4.1: Characteristics of the Major Types of Innovation Support Program

	Entrepreneurial Orientated	**Innovation process orientated**	**Policy orientated**	**Multi-level / portfolio orientated**	**Platform technology-oriented**	**Mission oriented**
Purpose	Establishing/ strengthening the enabling environment for entrepreneurship as a foundation of broader social and economic growth	Helping different actors realise and fulfil their role along various stages of the innovation processes	Strengthening innovation policy formulation and policy learning to better align with national growth and development strategies.	Strengthening innovation capabilities and enabling conditions across practice to policy scales	Building technological capability & associated networks & reorientating the enabling environment to deploy new platform technology in the service of defined social, economic & environment objectives	Mobilising specific innovation system actors, assets and innovation enabling conditions to address a shared and well-defined mission or challenge
Targeted issues	Lack of entrepreneurship culture and incentives; Inadequate or missing resources/ assets; Limited skills and expertise among entrepreneurs	Ineffective trust or incentives to collaborate. Lack of intermediation functions; Missing or inappropriate networks & patterns of collaboration	Ineffective/ missing/ misaligned policy setting to enable and direct/ target innovation toward national priorities	Systemic innovation failures of the innovation system	Missing or misaligned capabilities, networks, systems, infrastructure and policy and regulatory environment	Lack of prioritised agenda among actors; Lack of leadership & accountability; Missing incentives and enabling environment to target & collaborate on shared challenges
Scope	Usually not sector or locality specific; Focused on specific needs of innovators	Often sector specific; Focused on general needs of different actors	Not sector specific	Not sector-specific, but can be	Usually sector specific	Usually sector specific Usually tied to a specific geography
Typical interventions	Funding and knowledge support to entrepreneurs and incubators	Training researchers and facilitators to develop research-user links; cluster support.	Independent reviews of national STI and innovation policies	Advice and co-funding of national, regional and sectoral projects.	Training researchers, support to research & policy organisations & networks	Development of shared agendas around a specific social or other goal, eg a health goal.
Case Study (Appendix 1)	Entrepreneurial Ecosystem Development - The Scaling Frontier Innovation Program	Innovation Process Support- Sida's Innovation Systems Cluster Program in East Africa	Innovation Policy Support Programs - Policy Support Programs of Multilateral Agencies	Multi-Level Innovation Support Programs - the Inter-America Development Bank	Developing Capabilities in Platform Technologies – BioEARN and Bio-Innovate in East Africa	

Table 4. 2 Innovation System Failures or Stresses and the Intervention Priorities of Major Innovation Support Programs [45]

Framework for classifying innovation system interventions								
Innovation capacity gaps / **Intervention points**	**Policy setting, coordination, strategy planning, visions**	**Capability gaps**		**Infrastructure**		**Demand failures**	**Coordination failures**	**Learning failures**
		Skills	**info & knowledge asymmetries, silos**	**Soft**	**Hard**			
1. Entrepreneurial Orientated								
2. Innovation process orientated								
3. Innovation policy oriented								
4. Multi-level / portfolio orientated								
5. Platform technology-oriented								
6. Mission oriented								

[45] Ibid

Table 4. 3 Goals for Innovation Support Programs of IDIA Members[46].

Framework for classifying innovation system interventions								
Innovation capacity gaps / **Ecosystem Strengthening Goal**	**Ineffective policy frames- policy setting, coordination, strategy planning, visions**	**Capability gaps**		**Infrastructure**		**Demand failures**	**Coordination failures**	**Learning failures**
		Skills	info asymmetries, knowledge silos	Soft	Hard			
1. Build informed human capital								
2. Ensure accessibility of finance								
3. Establish supportive markets and infrastructure								
4. Create enabling policies and regulations								
5. Nurture a culture supportive of innovation across actors								
6. Support networking assets that enable productive ecosystem relationships								
7. Ensure equitable and inclusive ecosystem governance & participation								
8. Create smoother pathways to scale for specific innovations								
9.Mobilise around a development challenge								

[46] Results for Development and IDIA, 2021. Strengthening Innovation Ecosystems - Background Paper of 11 May, 2021. p.59

5. Lessons of Innovation-Oriented Development Programs

Key Lessons from Interventions Aiming to Strengthen Innovation Systems

Introduction

It is essential to make four points that frame the following discussion:

- **Explanation to prescription.** The innovation system approach was initially developed as analytical tool for explaining innovation performance in developed economies where innovation systems had evolved over many decades - with no overall system building design. Beyond emphasising the importance of effective interaction and policy coherence, it was neither a normative theory nor a theory of innovation system genesis. As is also the case with industry cluster approaches, and entrepreneurial ecosystems based on the Silicon Valley model, what were explanatory models became the basis for normative system-design models. Initially, these prescriptive models were simply based on what were seen to be the essential characteristics of the high-performing exemplar innovation system/cluster/entrepreneurial ecosystem. One consequence of the influence of these exemplars is that in many countries there is a high emphasis on the role of formal R&D and this has contributed to the enduring influence of S&T/technology push approaches.
  More recently a body of knowledge has begun to accumulate around the processes of innovation system/cluster/entrepreneurial ecosystem genesis and evolution. As a result, the conceptual foundations for prescriptive approaches to innovation system building are growing, but remains limited, particularly in LLMIC contexts.
- **LLMIC Context.** The majority of the literature on, and hence understanding of, innovation systems concerns studies and experience in OECD economies. The context of LLMICs is different in many respects, among which one of the most important is the large role of the informal sector.
- **Impediments to assessment.** There are two major impediments to making an assessment of the effectiveness of aid interventions in contributing to strengthening innovation ecosystems in LLMICs: the evidence base is very limited, in part due to the lack of long-term evaluations, and; there is a high level of diversity in the objectives and mode of interventions, and in the contexts in which the projects have been developed.
- **Systems frameworks.** There are a number of related innovation systems frameworks, including sectoral and regional innovation systems and innovation ecosystems. While these share many foundation concepts, the frameworks for entrepreneurial ecosystems are built on different conceptual building blocks. It would be a mistake to not differentiate these two different types of system/ecosystem strengthening endeavours and to seek to draw lessons from an undifferentiated assessment of the experience of innovation and entrepreneurship projects. Entrepreneurial ecosystems have a vital role in bringing new actors into innovation ecosystems- a role which will be particularly important in the decades of disruption that lie ahead – but they are not innovation ecosystems.

Taking these points into account, the following discussion draws out four broad findings from the reviews and case studies discussed above.

1. Challenges for Innovation Systems Strengthening Programs
2. Frameworks and Strategies for Systems Evolution
3. Experiment, Evaluation, Learning and a Theory of Change
4. Local R&D as a Driver of Change

Challenges for Innovation Systems Strengthening Programs

- **Appropriate field of focus.** The concept of an innovation system is a focusing device, bringing into the field of analytical and policy focus those actors, relationships, institutions etc of major relevance to the issue of interest – which might be a locality, a community, a sector, a problem etc. The boundaries are determined by relevance rather than reality. The focus can be at a micro, meso or macro level. Most aid interventions to support ecosystem strengthening are at the meso-level, where the ecosystems will be embedded in or linked to wider regional, sectoral and national innovation systems. Hence, there must be an awareness that the field of focus is

arbitrary and may need to change to address problems. For example, national level institutional issues (such as regulatory policies) may have unintended (or intended) negative impacts on the development of the focus innovation system. A range of national innovation system elements will usually have significant impacts on sub-national innovation ecosystems. While addressing these may be largely outside the immediate scope of an innovation ecosystem project, there may be opportunities to engage national-level policy-makers /stakeholders and stimulate learning and possibly change at the macro level. The inter-relations between innovation systems at different levels and between the components of innovation systems clearly argues for coordination among aid agencies.
While specific initiatives at the grassroots level can provide islands of development and exemplars for change, progress toward overall development, inclusion and sustainability objectives will be slow without an effective national innovation system in which these objectives are explicit goals[47]. However, as institutional change is an inherently political process, encouraging change in national innovation policies and investments may have little success where such change is not seen to be in the interests of dominant political groups[48]. In such situations, when the SDGs are incorporated in formal national development policy they can be seen as a shadow institution, for policy development.

- **Systems failure and complexity**. The available evidence shows that innovation systems in LLMICs usually have multiple systems failures, to the extent that it is very difficult to develop the level of endogenous drive that builds capabilities and linkages. One implication of that finding is that aid agency efforts to strengthen innovation ecosystems are likely to require sustained interventions.
  However, innovation systems are complex and a priori 'roadmaps' based on clear models of causation are not realistic. There are likely to be many possible points of intervention and it is likely that several should be addressed concurrently. One clear implication of that, and of the aid agency experience more generally, is the importance of bringing multidisciplinary skills, knowledge and perspectives to the tasks of diagnosis, support and evaluation[49].

- **Beyond S&T**. One strong message of the innovation systems approach is the key role of institutions, both formal policies and laws and the less formal cultures of organisations and societies. These shape perceptions and incentives, including the formation and behaviour of markets. They also embody the power relations in a society. The history of innovation system development is a story of the co-evolution of technologies, institutions and organisations – and hence the interdependence of technological, organisational and institutional innovation. This perspective is largely absent in the discussion of innovation system strengthening in LLMICs. It would be worthwhile to compile a note on the role of institutional innovation related to knowledge generation, acquisition and diffusion in the development experience of a range of countries.

- **Dynamic enterprises.** Ecosystems change when enterprises work to understand user needs, perhaps draw on advice and assistance to develop or modify products and processes, build links with suppliers and distributors, train employees and interact with regulatory agencies. Through diffusion and scaling-up many of these types of interaction are enacted again and again, throughout a region or economy. Through the process of establishment each enterprise builds a production system that involves some external links. Through problem-solving and innovation, an enterprise builds their micro-innovation system, involving internal and external links and capabilities[50]. The more challenging and novel the innovation and more frequent is innovation activity the more likely it is that a firm's micro-innovation system will consolidate

[47] World Bank, 2010. Innovation Policy: A Guide for Developing Countries. Washington, DC. World Bank.
[48] Cunningham, S & Jenal, M., 2016. Rethinking Systemic Change: economic evolution and institutions. Technical Paper. The Beam Exchange; Navarro, J.C., Benavente, J.M. and Crespi, G., 2016. The new imperative of innovation: Policy perspectives for Latin America and the Caribbean. Washington: Inter-American Development Bank.
[49] See: *CGIAR, 2020. CGIAR* 2030 Research and Innovation Strategy Transforming food, land, and water systems in a climate crisis CGIAR *https://cgspace.cgiar.org/bitstream/handle/10568/110918/OneCGIAR-Strategy.pdf*
[50] Culture and routines are intra-firm institutions.

transitory links into the channels of an innovation system, and stimulate change in external organisations.

- **Endogenous momentum**. One key finding from the myriad studies of the development and ongoing performance of innovation systems, clusters and entrepreneurial ecosystems in OECD countries is that their evolution is usually driven by endogenous processes. Dynamic systems draw on external assets when needed and address (successfully or not) external constraints, but it is the internal momentum, based on opportunity, challenge and competition, that leads to asset accumulation, relationship building and innovation in all its forms. Hence, it is essential that aid interventions focus on developing endogenous change capacities and drivers – so that aid agency intervention strengthens the agency of local participants.
  The studies in OECD countries also show that actors in innovation systems collaborate when that is necessary to achieve their goals. Collaboration to solve problems, builds interdependence, social capital and institutions- and ultimately, if growth and differentiation continues, an innovation system. Developing collaboration to address shared problems and around shared goals builds participation and more aligned stakeholders. How problems are identified, framed and addressed by all stakeholders is critical for ecosystem development. There is a risk that experts can stunt the growth of participant agency by the way that problems are framed and addressed.

Frameworks and Strategies for Systems Evolution

- **Sustained engagement.** A clear finding from this review is that innovation system formation and strengthening usually requires sustained engagement over a long period of time. The processes of engagement with stakeholders and developing a situation assessment and shared agenda for change should not be rushed to meet pre-conceived agency timelines and budgets. A range of complementary initiatives may be necessary, although the types of initiative needed at different stages may only be evident over time[51].

- **Frameworks for innovation system emergence and evolution.** The processes of innovation ecosystem emergence and early-stage formation in LLMICs requires further analysis, drawing on studies in different contexts. While the objective for analysis should not be the development of roadmaps, a stronger conceptual framework would assist diagnosis and evaluation of progress. A range of tools can also assist these processes of assessment and framing, including system mapping, foresight and scenario development[52]

- **Transformation of innovation systems.** The development of innovation systems in OECD economies has included periods of transformational change, rather than a steady process of growth along a trajectory of accumulation[53]. Those periods of transformational change have involved substantial economic and social disruption, with skewed distributions of costs and benefits. What is new is that the perspective through which analysts, and to some extent governments, frame policies for transformational change is now an innovation systems perspective. Hence, the directionality of innovation system evolution is seen as an explicit policy issue, rather than the 'natural' outcome of market forces[54]. The SDGs, for example, aim to set a normative direction for policy, including innovation policy.
  Many different approaches and frameworks for system transformation have been proposed[55].

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[51] For example: *CGIAR, 2020. CGIAR 2030* Research and Innovation Strategy Transforming food, land, and water systems in a climate crisis. *CGIAR;* Sida, 2019 Position Paper. Support to Innovation and Innovation Systems within the Framework of Swedish Research Cooperation – taking stock, lessons learned and the way ahead. Sida.
[52] Catalyst 2030 Consortium, 2020
[53] See, for example: Baumol, W.J., 2014. The free-market innovation machine. Princeton University Press; Klepper, S., 2015. Experimental capitalism. Princeton University Press; McCraw, T.K., 1998.Creating modern capitalism: how entrepreneurs, companies, and countries triumphed in three industrial revolutions. Harvard University Press; Louçã, F., 2020. Chris Freeman forging the evolution of evolutionary economics. *Industrial and Corporate Change*, *29*(4), pp.1037-1046; Clark, J., Freeman, C. and Soete, L., 1981. Long waves, inventions, and innovations. *Futures*, *13*(4), pp.308-322
[54] For example: Schot, J., Daniels, C., Torrens, J. and Bloomfield, G., 2017. Developing a shared understanding of transformative innovation policy. *TIPC Research Brief*, *1*.
[55] For example: Schot, J. and Steinmueller, W.E., 2018. Three frames for innovation policy: R&D, systems of innovation and transformative change. *Research Policy*, *47*(9): 1554-1567. See also Appendix 2.

One that identifies types of 'transformational system failures' along with market and 'structural system failures' is shown in Table 5.1.
Innovation system strengthening strategies that combine mission-oriented innovation policies might also provide an approach to directionality. While such interventions would be likely to provide a range of temporary incentives for participant engagement, the processes of collaboration and capability development could lead to enduring innovation system change[56]. Analysis of processes of innovation system genesis, as discussed above, should take into account the literature on transformative change and on innovation missions, although most of those frameworks have been developed for national-level policies and innovation systems.

Table 5.1: Failures in the context of transformative change[57].

	Type of failure	**Failure mechanism**
Market failures	Information asymmetries	Uncertainty about outcomes and short time horizon of private investors lead to undersupply of funding for R&D.
	Knowledge spill-over	Public good character of knowledge and leakage of knowledge lead to socially sub-optimal investment in (basic) research and development.
	Externalization of costs	The possibility to externalize costs leads to innovations that can damage the environment or other social agents.
	Over-exploitation of commons	Public resources are over-used in the absence of institutional rules that limit their exploitation (tragedy of the commons).
Structural system failures	Infrastructural failure	Lack of physical and knowledge infrastructures due to large-scale, long-time horizon of operation and ultimately too low return on investment for private investors.
	Institutional failures	Hard institutional failure: Absence, excess or shortcomings of formal institutions such as laws, regulations, and standards (in particular regarding IPR and investment) create an unfavourable environment for innovation.
	Soft institutional failure	Informal institutions (e.g. social norms and values, culture, entrepreneurial spirit, trust, risk-taking) that hinder innovation.
	Interaction or network failure	Strong network failure: Intensive cooperation in closely tied networks leads to lock-in into established trajectories and a lack of infusion of new ideas, due to too inward-looking behaviour, lack of weak ties to third actors and dependence on dominant partners.
Transform-ational system failures	Directionality failure	Lack of shared vision regarding the goal and direction of the transformation process; Inability of collective coordination of distributed agents involved in shaping systemic change; Insufficient regulation or standards to guide and consolidate the direction of change; Lack of targeted funding for research, development and demonstration projects and infrastructures to establish corridors of acceptable development paths.
	Demand articulation failure	Insufficient spaces for anticipating and learning about user needs to enable the uptake of innovations by users. Absence of orienting and stimulating signals from public demand Lack of demand-articulating competencies.
	Policy coordination failure	Lack of multi-level policy coordination across different systemic levels (e.g. regional–national–European or between technological and sectoral systems; Lack of horizontal coordination between research, technology and innovation policies on the one hand and sectoral policies (e.g. transport, energy, agriculture) on the

[56] Hekkert, M.P., Janssen, M.J., Wesseling, J.H. and Negro, S.O., 2020. Mission-oriented innovation systems. *Environmental Innovation and Societal Transitions*, *34*, pp.76-79; Janssen, M.J., Torrens, J., Wesseling, J.H. and Wanzenböck, I., 2021. The promises and premises of mission-oriented innovation policy—A reflection and ways forward. *Science and Public Policy*, *48*(3), pp.438-444.
[57] Weber, K.M. and Rohracher, H., 2012. Legitimizing research, technology and innovation policies for transformative change: Combining insights from innovation systems and multi-level perspective in a comprehensive 'failures' framework. *Research Policy*, *41*(6): 1037-1047. p.1045.

		other; Lack of vertical coordination between ministries and implementing agencies leads to a deviation between strategic intentions and operational implementation of policies; No coherence between public policies and private sector institutions; No temporal coordination resulting in mismatches related to the timing of interventions by different actors.
	Reflexivity failure	Insufficient ability of the system to monitor, anticipate and involve actors in processes of self-governance; Lack of distributed reflexive arrangements to connect different discursive spheres, provide spaces for experimentation and learning; No adaptive policy portfolios to keep options open and deal with uncertainty.

- **Entrepreneurs can be agents of transformational change**. In all economies entrepreneurship of different types has a vital role in transformational change. In the market domain, the business experiments of entrepreneurs 'discover' viable business models for new enterprises. Organisational and institutional entrepreneurs also have a vital role - as the co-evolution of technologies, organisations and institutions is a key driver of innovation system development. For these reasons, a comprehensive approach to innovation ecosystem development and transformation must include support for these different forms of entrepreneurship[58]. The Catalyst Consortium's supporting systems change are relevant here:

Catalyst 2030 Consortium's Principles for Supporting Systems Change[59]

1. Embrace a systems mindset by being clear about the systems you want to change, incorporating systems change into your DNA, and actively looking for funding opportunities
2. Support evolving paths to systems change by funding systems leaders with transformative visions of improved systems rather than projects, investing in learning and capability building and encouraging collaboration among systems change leaders
3. Work in true partnership by acknowledging and working against power dynamics, providing support that fits systems change leaders' needs, and being mindful of their limited resources
4. Prepare for long-term engagement by being realistic about the time it takes to achieve systems change, acknowledging that the path of the initiatives will change along the way and encouraging realistic ambitions
5. Collaborate with other stakeholders by aligning with other funders, building networks for systems change leaders, and leaving the leading role to systems change leaders.

Experiment, Evaluation, Learning and a Theory of Change

- **Adaptive management**. Complexity, uncertainty and the need for stakeholder participation mean that a priori road maps for change are not feasible. A learning-focused adaptive management approach is needed[60]. A number of reviews of programs note the possible tensions between goals of efficiency and accountability (performance to budget) on the one hand and learning and adaptive management on the other. Effective adaptive management requires ongoing monitoring with rapid feedback and timely changes in approaches and resource allocation ('*complex activities, requiring on-going adaptations and responding to contingent outcomes*'[61]) but logframe project management approaches do not enable the level of flexibility required.
- **Using a Theory of Change (ToC)**. A theory of change expresses the shared view of the context, the challenge and how the intervention will work. It is a sense-making tool, a basis for communication documents and a framework for evaluation. The process of its development is a key learning and engagement-building activity, must be participatory and hence may be

[58] This is why some recommend a focus on 'change leaders' in communities- for example Catalyst 2030 Consortium, 2020.
[59] Catalyst 2030 Consortium, 2020. Embracing Complexity - Towards a Shared Understanding of Funding Systems Change. Catalyst 2030 Consortium. p.7-8
[60] Walji, A., 2016. Why innovation seldom scales, and what to do about it. in Ramalingam, B. and Bound, K. (Eds) 2016. Innovation for International Development - Navigating the Paths and Pitfalls. NESTA.
[61] Rath, et al. 2012a, p. 110

challenging and contentious[62]. Similarly, the ToC is reviewed and modified based on learning throughout a project.

- **Encouraging an experimental approach to innovation policy development.** Encouraging and assisting innovation policy organisations in host countries to take an experiment and learning approach to policy development will assist the strengthening of innovation systems. The following comment on IADB experience in Latin America makes this point well, and is worth quoting at length:
  "..given the importance of policy discovery, institutions for successful [productive development policies] need a policymaking process that fosters learning, evaluation and adaptation. Effective search needs a culture in which calculated risks and pilot programs are encouraged and a fair share of policy failures is regarded as the expected outcome of a sound process. The other side of the learning coin is evaluation. An experimental mindset to search out and try policy solutions needs to be supplemented by systematic and unbiased evaluation in order to learn from the experience, refine solutions and eliminate what does not work. Actively searching, trying solutions, and evaluating them to refine and weed out are very tall orders for public institutions…
  These challenging features of successful productive development policies point to three institutional capabilities that countries and agencies need to appropriately design and implement them: Technical capabilities in order to resolve the technical difficulties associated with policy adoption; Organizational capabilities, such as managerial skills, the ability to foster an environment in which experimentation, evaluation and learning is encouraged, and the ability to collaborate effectively with the private sector and other areas of the public sector; and Political capabilities in order secure continuous support, and protect the policy process from undue influence by businesses, policymakers or politicians. The quality of the [technical, organisational and political] institutional capabilities is a key factor for the success of the successful [productive development policies]….
  ... building capabilities also involves a sizable dose of learning by doing within a context that encourages experimentation, evaluation and policy adaptation. It is in the process of identifying problems and learning how best to address them through iteration and adaptation that countries and agencies can expand their capabilities for policy design and implementation"[63].
- **Evaluation for learning.** As emphasised above evaluation has an essential role in learning as well as accountability. Development agencies increasingly invest in effective evaluation: '*An organization that is open to learning, from evaluation and other evidence, is more likely to achieve transformational development"*[64].
  However, there is a need for both continuous evaluation to facilitate sharing learning and modification of the ToC, and longer term evaluation capture and codification of the overall outcomes in terms of innovation system strengthening and learning. That longer term may be long after the intervention has wound down: *Measuring institutional and systems change is a long-term endeavour…the further down the results chain one goes, the longer it takes to observe and measure changes."*[65]

Local R&D as a driver of innovation.

The IDIA (2021) review emphasises the importance of 'true' (ie high novelty rather than incremental innovation) and the Sida position paper of 2019 emphasises the role of local research organisation

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[62] Weiss C., 1995. *Nothing as Practical as Good Theory: Exploring Theory-Based Evaluation for Comprehensive Community Initiatives for Children and Families*. In: New Approaches to Evaluating Community Initiatives, Washington DC: Aspen Institute, pp. 65–92.
Davies R. (2018). *Representing Theories of Change: A Technical Challenge with Evaluation Consequences*. CEDIL Inception Paper 15: London. https://cedilprogramme.org/wp-content/uploads/2018/08/Inception-Paper-No-15.pdf

[63] Stein, E., Crespi, G. (Eds.) 2014. Rethinking Productive Development Sound Policies and Institutions for Economic Transformation. Inter-American Development Bank. p.29-32.

[64] AfDB, 2020. Six key lessons to harness knowledge for transformational change from the AfDB's Development Evaluation Week 4 December 2020. http://idev.afdb.org/index.php/en/news/six-key-lessons-harness-knowledge-transformational-change-afdbs-development-evaluation-week

[65] Innovation-Fellowship-Program-Emerging-Insight-Brief-Sept-2016.pdf (rockefellerfoundation.org)

and of building intervention strategies around 'Triple Helix' models[66]. The major beneficiaries of this approach may not be marginal groups:

> *"[Some suggest that] a first objective should be both to connect local knowledge with existing codified and explicit knowledge and to foster the localization of affordable existing technologies. They expected that this would mostly benefit actors from the government, private and civic sectors and from universities, as these actors are directly involved in building capacities and enhancing the interactions between and among them. The question of how this development will alleviate poverty and social inequality in practice is more challenging. The poorest will mostly benefit from later positive spillover effects, such as improvements in overall employment patterns, boosted economic growth and the fostering of institutional capabilities."*[67]

Aubert (2010) notes that even modestly innovative ideas can have major impacts (for example the uptake of mobile phones and development of applications in their use), including in terms of inequality and sustainability[68]. Other commentators also emphasise the importance of mobilising the existing knowledge base before embarking on research to generate new knowledge:

"*Working and reworking the existing stock of knowledge to generate local innovations is the dominant activity in innovation in poor countries. … Most firms seeking to innovate draw on knowledge first from other firms. Only after they build their internal capacity do they become motivated to interact in significant ways with research organisations.*"[69]"

"*the value of R&D emerges from its role as a vehicle for technology transfer and adaptation"*[70]

Investing in local research is generally part of a strategy to build research capabilities and develop linkages with users. This may involve trade-offs with other objectives, such as addressing inclusion, sustainability and productivity issues in the short term, or achieving excellence based on publications in international journals. Those trade-offs are likely to be different in the agricultural and health sectors compared with the industrial sector. What is important is to be aware of the assumptions made about those trade-offs, and to consider the scope for institutional innovation in the policies and organisations relevant to the knowledge infrastructure- for example forms of 'innovation hubs' outside the culture of the university and focused on problem solving have been one form of effective intermediary.

Future Challenges for LLMICs- Challenges at the Frontier

Developing countries face three concurrent dimensions of challenge for innovation policy and for innovation systems strengthening. As summarised in Figure 5.1 these dimensions are those of:

4. Mastery of current technologies in order to raise performance in domestic industries and improve domestic value-adding and employment, build infrastructure to enable growth and upgrade in global value chains;
5. Begin mastering of new digital technologies (Industry 4.0) and biotechnology, particularly to effectively apply these technologies in all sectors and to build a high level of innovation competence in niches of particular national relevance; and
6. Effectively addressing growing challenges of climate change and of inequality across regions and social groups.

The particular form of these challenges and the current scope for addressing them varies widely among countries. However, no country can afford to not address all three challenges. Key questions for each country are:

- The balance of focus on these three dimensions of challenge;

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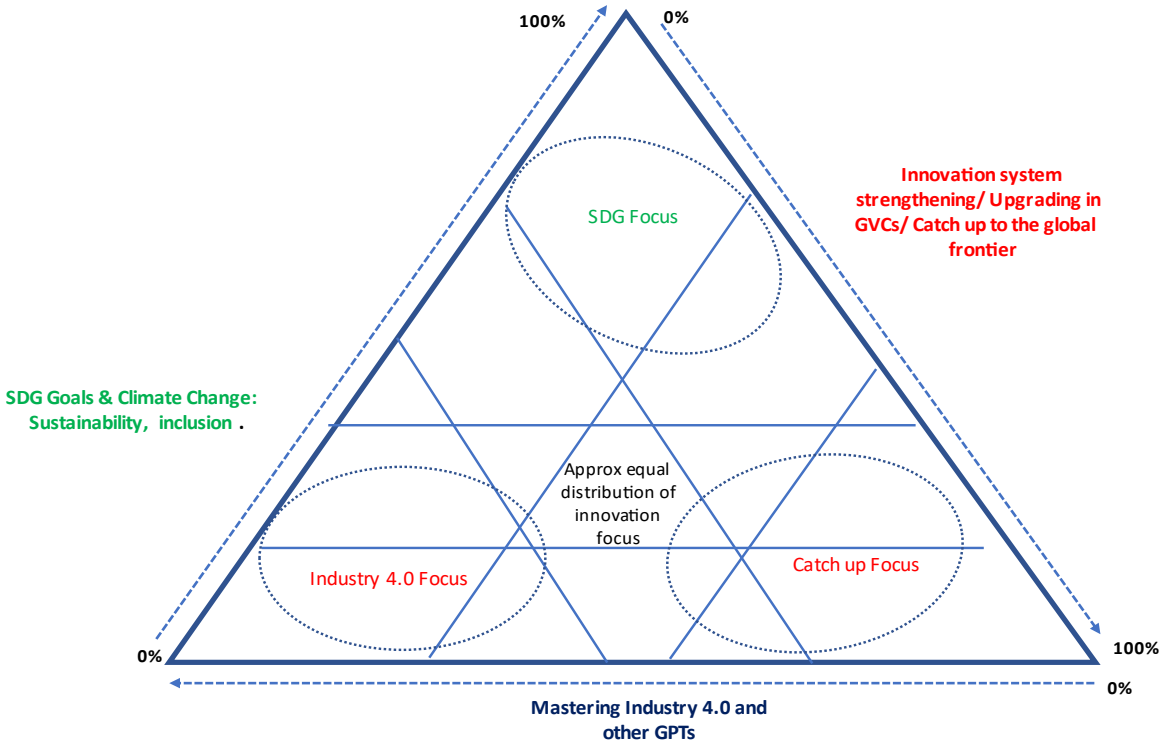
[66] The discussion of this important issue in Sida, 2019 and in IDIA, 2021 is ambiguous.
[67] Hooli, L.J. and Jauhiainen, J.S., 2017. Development aid 2.0: Towards innovation-centric development co-operation: The case of Finland in Southern Africa. In *2017 IST-Africa Week Conference* (pp. 1-9). IEEE.
[68] World Bank, 2010. Innovation Policy: A Guide for Developing Countries. Washington, DC. World Bank.
[69] Rath, et al, 2012a, p.18
[70] Stein, E., Crespi, G. (Eds.) 2014. Rethinking Productive Development Sound Policies and Institutions for Economic Transformation. Inter-American Development Bank.

- What policies and capabilities will be required for effective responses in to each challenge;
- The scope for approaches that integrate responses to the challenges.

Figure 5.1 Addressing Three Unavoidable Challenges- Concurrently



Principles for Strengthening Innovation Systems.

Taking into account the insights from this review of international experience of initiatives to strengthen innovation (and entrepreneurial) systems, and the innovation-related challenges that LLMICs are likely to face over the next 20 years, a set of eight inter-related principles for innovation system strengthening and transformation are outlined below:

Planning to Learn: Innovation projects, particularly in LLMICs. must be designed and developed in a context of complexity, uncertainty and multiple market, systems and transformational failures. Detailed *a priori* planning must give way to an active learning approach A learning plan considers learning by all stakeholders is a key objective of all innovation support initiatives – learning about opportunities and risks, the interests and capabilities for other stakeholders, the areas of shared interest, etc. A 'learning plan' approach would support increases in investment as uncertainty decreases.

An Evolving Theory of Change: A theory of change (ToC) makes explicit the assumptions that shape the initial approach and the decisions regarding scope, participants, objectives etc. Developed collaboratively, it forms the initial basis of shared views of the situation, the challenges and the approach to change. While the ToC reflects the initial diagnosis and assessment (for example, of the role of incentives, risks and constraints on change) it evolves as assumptions are tested and perceptions change. It helps to and identify the stresses and conflicts (between groups, areas of policy and objectives) that arise. The process of developing and reviewing the ToC is a key aspect of learning.

Adaptive Management: A planning approach and the use of an evolving ToC means that detailed pre-project planning is not appropriate. An adaptive management approach is needed. This has challenging implications for staffing, budgeting and accountability as project managers must respond to effectively to contingencies and emerging opportunities.

Policy Experiments: In the context of innovation and innovation policy, change involves experiment. Managed experiment, robust evaluation and openness to learning builds knowledge, capability and confidence.

Organisational and Institutional Innovation: Technologies, organisations and institutions (in the sense of rules, conventions, policies, cultural norms) co-evolve. The lack of organisational and institutional innovation is often what blocks or reduces the returns to/ incentive for/ risks of technological change. Untethering perceptions of innovation from a fixation with technology can be a step toward empowering organisational and institutional innovation- which is, after all, the essence of innovation system growth and performance. More broadly, and including at the level of national innovation system, emphasising the extent to which all organisational and policy models are contingent can encourage more open thinking about the scope for innovation for each context.

Endogenous Drivers: Innovation system formation, growth and change is an endogenous process. The primary objective of an intervention to support innovation systems strengthening is to develop the agency of the participants, particularly those with the least agency, and to grow the level of endogenous change momentum and capability. Project managers can assist in identifying opportunities, barriers, risks and incentives for all participants. But it is participants' perceptions of those issues that will frame how problems and opportunities are assessed and addressed.

Entrepreneurship: Entrepreneurship in all its forms – leading the formation of new for-profit or social enterprises and the formation or transformation of organisations and policies – is a form of (business, social, organisational, institutional) experiment and a critical driver of change. Support for entrepreneurs is one important dimension for supporting innovation system strengthening and transformation.

Sustained Engagement: Another implication of this approach to innovation support is that the key processes of capability building, alignment of interests, trust building, discovery of opportunity etc are likely to require sustained support over perhaps long time periods. For innovation systems building, innovation provides a focusing device for learning and relationship building, and not an end in itself. It is very likely that an effective approach to innovation system strengthening will require a range of complementary interventions, for example, training, facilitation, co-funding.

Appendix 1 Case Studies

1. Innovation Process Support- Sida's Innovation Systems Cluster Program in East Africa
2. Entrepreneurial Ecosystem Development - The Scaling Frontier Innovation (SFI) Program
3. Developing Capabilities in Platform Technologies – BioEARN and Bio-Innovate in East Africa
4. Innovation Policy Support Programs - Policy Support Programs of Multilateral Agencies
5. Multi-Level Innovation Support Programs - the Inter-America Development Bank

Case Study 1 Research Cooperation: Sida's Innovation Systems Cluster Program in East Africa (ISCP – EA)

Program - Scope and Modalities

The Sida 'Research Cooperation' program in East Africa is one component of a broader program that is focused on cluster (also labelled Triple Helix) initiatives with universities as anchor participants. This case study focuses on the program in Tanzania and Uganda. The program began with eighty cluster initiatives in these two countries in 2006 and by 2011 there were 50 cluster initiatives[71]. Sida expenditure over 2005 – 2009 was about SEK7million. The development, design and implementation of the program was underpinned by 30 years of Sida experience in East Africa and strong relationships with many of the African participants[72].

The program was stimulated by the participation (supported by Sida) of individuals from East Africa in a Competitiveness Institute conference in Sweden. This led to a request for Sida support for a cluster-orientated initiative. It was then initiated by a one-week training session in Tanzania and Uganda in 2005, with about 40 stakeholders in all representing the university, industry and government. The program included three phases (pilot, scaling up and implementation and consolidation) and was estimated to require at least ten years of support[73]. The program continued after 2009 and was evaluated in 2011. Implementation was outsourced in 2007 to the Scandinavian Institute for Cooperation and Development, SICD at the Blekinge Institute of Technology.

Theory of Change and Innovation System Focus and Objectives

The theory of change could be set out as:

- Innovation can contribute to poverty alleviation through an increase of productivity, improvement of quality of products and services, and growth of small and medium size enterprises.
- The enhanced innovativeness and competitiveness was also expected to lead to more environment-friendly products and services. Capacity building in innovation, marketing, and related issues were expected to improve gender relations especially in rural areas, and as a result of development efforts within the agro-industry sector.
- Innovations require interaction between researchers, industry and political bodies, effective communications, and networks and partnerships across organizations and channels.
- Universities are able to offer education, training, research and advisory services; they are a potentially powerful vehicle for development, particularly with respect to S&T.
- Research by the universities in response to demand by firms would be vital for value-creation in the clusters.
- Links between university and society may still be weak in many low-income countries.
- Even if such links exist, they need to be systematically organized to stimulate cooperation.

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[71] Trojer, T. et.al. (2014) Inclusive innovation processes – experiences from Uganda and Tanzania, African Journal of Science, Technology, Innovation and Development, 6:5, 425-438.
[72] Trojer, T. et.al. (2014)
[73] Rath, A. et al. 2012a Evaluation of Sida's Support to Innovation Systems and Clusters, a Research Cooperation Initiative. 1-Main report. Sida, 2012. (Up to 2011 more than 200 facilitators were trained.)

- Local and national development could be accelerated if both universities and industry were encouraged to work actively together and if universities would assume an "entrepreneurial" role.

The approach represented a shift in focus on the enabling environment for innovation, the innovation system, rather than on individual innovations. There was an expectation that the participation in clusters by actors from governmental agencies, private enterprises and universities would complement each other in the innovation process and also generate a co-evolutionary learning process that would mobilise the resources to spur product development, policy formulation and academic research[74]. Facilitators, the majority were researchers or linked to universities, had critical roles in forming and nurturing the links and communication between cluster members.

Beyond the cluster projects Sida enabled researchers linked to the program to participate in international networks through conferences such as Globelics, African Innovation Summit in 2018 and research studies such as UNIDEV. They also supported a "Forum on Higher Education and Research" located at UNESCO and a policy research network in Africa.

Outcomes and Impacts

The 2012 evaluation of the program was highly positive, while noting that outcomes varied across clusters with some failing to develop, citing evidence of significant improvements in outputs, productivity, employment and incomes among participating firms. In terms of innovation capacity the evaluation listed: increased human resources (trained facilitators, more experienced researchers and students); learning (knowledge transfer, better understanding of problems and solutions by all, including policy makers); innovation system strengthening (improved links, coordination and trust/social capital, greater involvement of universities in local problem solving); institutional (improved government policies)[75].

In Tanzania, the initial program led to an expanded national program of cluster development: *In 2010 the management of the cluster support was taken over by* [Tanzanian Commission for Science and Technology] *COSTECH which has the role of linking researchers to other actors in society. The programme trained facilitators and cluster firms to develop business models and offered competitive seed funding and more than 40 clusters were trained. Since 2015 a pilot for a more systemic approach has been developed aiming at developing a national model for support to micro, small and middle-sized enterprise (MSME). This is a collaborative effort between Sweden, COSTECH and Small Industries Development*[76].

Challenges and Lessons

The program developed through several phases and its success seems to have benefited from:

- A foundation of relationships with key organisations in the region, particularly several universities, based on 30 years of involvement in aid programs- this provided a foundation of trained and motivated professionals, prepared to work together[77];
- The time allowed (three years) for the core groups to develop their awareness, interest and contribute strongly to the design of the pilot program – ensuring a 'demand led' approach, local ownership and adequate situational assessment;
- Engaging senior decision-makers in the design of the intervention;
- An approach that supported substantial training of cluster managers/facilitators, enabled experiment and change and which also built relationships with between participants and specialists in Sweden;
- Early wins by focusing on short term benefits to firms, leading to greater trust among the different stakeholders, and hence the initiatives increased social capital[78].

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[74] Trojer, etal, 2014, p.426.
[75] Rath et al, 2012a. The evaluation also notes the high level of learning by SIDA. Rath, A. et al. 2012b Evaluation of SIDA's Support to Innovation Systems and Clusters, a Research Cooperation Initiative. II -Individual cases. SIDA.
[76] SIDA, 2019 Position Paper Support to Innovation and Innovation Systems within the Framework of Swedish Research Cooperation – taking stock, lessons learned and the way ahead. SIDA. P.14
[77] Rath, et al, 2012a, p105
[78] Rath, et al, 2012a, p. 103

- Expansion of projects as new participants joined specific initiatives and the 'platforms' (ie networks of organisations and individuals with an agreed purpose and mode of decision making) addressed additional goals;
- Extending the learning and impact by funding policy research and participation of decision-makers in conferences and evaluation activities etc

There were several factors that limited success:

- The evaluation noted the tensions between the goals of learning and the need for adaptive management on the one hand and the requirements for efficiency and accountability on the other. Effective adaptive management required ongoing monitoring with rapid feedback and timely changes in approaches and resource allocation ('*complex activities, requiring on-going adaptations and responding to contingent outcomes*'[79]), but the design of the management did not provide this level of flexibility.
- The evaluation also noted that the design of the projects (as well as the expansion plans) appear to have under-estimated the difficulties of facilitating cluster development, and the time and resource commitments required by the facilitators.

Key Lessons

- While universities were able to offer education, training, research and advisory services that can be growth promoting, the least important dimension of the role was research. In relation to this observation the evaluation also noted that most productive activities in the clusters were based on traditional knowledge and there was little interaction with the modern sectors. The 2012 evaluation found that "*working with and reworking the stock of knowledge is the dominant activity in innovation.*" *[and] the bulk of innovations … are not immediately based on new research-based knowledge.*[80]' Taking this further, the evaluation notes: '*University-based, R&D intensive cluster initiatives such as sisal and energy have been unsuccessful.. [and] there is a general disinterest of local industry to engage with academically oriented research.*[81]'
- There can be significant value in training facilitators, eg cluster managers, incubator managers, knowledge transfer officers, etc.
- Recognise that innovation system, triple helix and cluster frameworks provide broad perspectives rather than prescriptive approaches and hence there is a need for ongoing experiment and research. In this program pilot and exploratory grants led to larger country programs, building on the lessons and relationships.
- While the innovation system concept provided useful frameworks their lack of an analysis of power relations led to overestimating the influence of policy makers and underestimating the role of other actors and bottom-up approaches.
- As multi-stakeholder participation and cooperation was essential for success, and '*..given that all the stakeholders are subject to multiple, often non-overlapping, and sometimes even conflicting institutional rules and incentives..*[82]" a shared 'theory of change' linked to with agreed targets is essential both for effective cooperation and collective learning.
- If a predetermined and limited (eg less than 10%) level of overheads is set, then efficiency and learning objectives are likely to be in conflict[83]. Investments in system diagnostics, learning, cooperation and coordinating were critical for success. Projects should be informed by 'learning plans'[84].

Sources

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[79] Rath, et al. 2012a, p. 110
[80] Rath et al, 2012a, p. 121
[81] Rath, et al 2012a, p 124-5
[82] Rath, et al. 2012a, p. 126
[83] Rath et al, 2012a
[84] For example: Dai, Z., 2012. Toward a learning-based view of innovation. Competitiveness Review: An International Business Journal. Jan 20

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Case Study 2 The Scaling Frontier Innovation (SFI) Program

Program - Scope and Modalities

The Scaling Frontier Innovation (SFI) Program is an initiative of the Australian Government Department of Foreign Affairs and Trade's (DFAT) innovationXchange. The program, which involved a total investment of about A$15m, began in 2017 and some components will run to the end of 2021. SFI is an experimental program to test hypotheses around what types of support may scale the development impact of social enterprises in the Asia-Pacific most efficiently, effectively, and sustainably. It was also experimental in working with an innovative performance framework. SFI aimed to stimulate private sector contributions to help more social innovators and their social enterprises grow their reach and impact. SFI has three components which focus on different part of the entrepreneurial ecosystem85:

- **Frontier Innovators** to support selected high-potential innovators in the region with grants of up to A$100,000 to promote business growth, as well as range of business development support services. The component also involved of detailed ecosystem maps, with recommendations for additional support, for each country in the region86. Each participating enterprise was given the opportunity to co-design their program with input from external experts and this co-design approach was combined with the use of flexible funding to enable enterprises to identify how they wanted to allocate resources.
- **Frontier Incubators** to build the capacity of incubators and accelerators to support and promote connectivity among ecosystem actors. Drawing on the advice of 20 international experts, 11 support organisations were selected to implement this component and support the incubators. The selection of these organisations was based on experience incubating/accelerating impact ventures, training or setting up incubators/accelerators, and working in emerging markets, as well as their willingness to adapt their approaches to new contexts. Nineteen social innovator organisations from seventeen countries were chosen, from 112 applications, to participate in this component. The organisations ranged from co-working hubs and education-based accelerator platforms to private sector organisations and gender-specific business incubators. The support organisations and the incubators collaborated to develop support in multiple formats (including webinars, seminars, study tours, mentoring calls), contributing to the development and testing of content that has been made accessible to other incubators and accelerators in the region.
- **Frontier Brokers** to connect investors to enterprises generating impact. Partner organisations were selected through a competitive procurement that included a co-creation workshop that sought to encourage collaboration among the partners and ensure a focus on 'gender lens investing and inclusivity'[87].

This innovative program has developed a strong systems approach and has worked with a performance framework incorporating social inclusion goals and lessons from prior development experience. The framework has six dimensions that have shaped all elements of the program:

- Co-Creation
- Co-Design - The program developed collaboration with a diverse range of entrepreneurship-orientated organisations (chosen through open selection processes), with which the interventions were co-designed.
- Applying a Gender Lens to Incubation and Investing – the SFI Program Gender Strategy. The Strategy defined a gender lens as a study of how power, privilege and bias interact with gender in varying contexts and gave a framework of considerations before applying a gender lens, such as context, assumptions and bias in approaches and power dynamics in structures.
- Adaptive Management - the adaptive management approach is linked to a strong monitoring, evaluation and learning (MEL) approach, involving continuous learning.
- Complexity Aware Research and Diagnostics
- Flexible Funding.

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[85] Australian Aid, 2020, p.1. A fourth component, focused on impact investing funds, was cancelled due in part to budget cuts.

[86] Mapping and Analysis of Entrepreneurial Ecosystems Incubators and Accelerators in the Asia- Pacific

[87] Australian Aid, 2020, p. D

The SFI program has involved the participation of at least 20 independent aid and entrepreneurship organisations and hence has drawn on a diversity of skill, knowledge and experience, in a mode that encouraged collaboration and reflection.

The SFI program is similar to USAID's Partnering to Accelerate Entrepreneurship (PACE) initiative which works with intermediaries to improve entrepreneurial ecosystems, and supports individual 'social' entrepreneurs. The program, operating since 2013, has worked with over 50 incubators, accelerators, and seed-stage impact investors and invested around US$20m. The program focuses on enabling private sector investment in 'early stage small and growing businesses' and encourages the intermediaries to develop new approaches to invest in and support these ventures. Like SFI, PACE's experience is that combing investment with support (prior to and following the investment) increases the performance of the ventures. Again like SFI the financial sustainability of the intermediaries usually required additional after the initial grant[88].

As was the case for DFAT's SFI the PACE evaluation faced challenges: "Data availability, consistency, and verifiability found across data sources posed considerable challenges…..This prohibited an evidence-based response to the review questions and, in particular, the assessment of model effectiveness and program sustainability[89].

Theory of Change and Innovation System Focus and Objectives

The ToC, which was always designed as an ecosystem change project, could be stated as:

1. The scaling of social enterprises could contribute significantly to sustainable poverty reduction in the Asia Pacific region;
2. The types of support that can scale the development impact of social enterprises most efficiently, effectively, and sustainably can be developed (and tested) through innovative approaches to design, implementation, and monitoring and evaluation, based on an evolving performance framework;
3. By demonstrating the efficacy of new market-based approaches in achieving development impacts, the SFI program can influence the delivery of aid in the Asia Pacific region[90].

Hence, the goal for each of the outcome areas was to develop approaches that were efficient, effective and sustainable. Consistent with an adaptive management approach, outcome areas and indicators were developed but specific targets that may reduce flexibility were not[91].

Outcomes and Impacts

Two organisations were MEL partners throughout the program contributing to adaptive management and assessment of the overall learning question: *what was the effect of applying innovative approaches to design, implementation, monitoring and evaluation of the SFI Program*? The continuous evaluation also considered SFI performance against the OECD's Development Assistance Committee's (DAC) evaluation criteria and the Whistler Principles (Table A.1.1[92]).

Table A.1.1 Innovative Approaches Mapped Against the Whistler Principles.

SFI Innovative Approaches	Whistler Innovative Principles

[88] Aidis, Ruta, Fehlenberg, Kate Eissler, Sarah, Quinn, David and Brenna Casey. 2020. *Second Strategic Review of Partnering to Accelerate Entrepreneurship (PACE) Initiative*. Washington, DC: Learning, Evaluation and Analysis Project (LEAP III) Activity, Integra Government Services LLC, Prepared for the US Agency for International Development; USAID, 2017. Accelerating Entrepreneurs: Insights from USAID's Support for Small and Growing Businesses. USAID. *Accelerating Entrepreneurs: Insights from USAID's Support for Small and Growing Businesses*; USAID, 2018. Accelerating Entrepreneurs: Insights from USAID's Support of Intermediaries. USAID. **Accelerating Entrepreneurs: Insights from USAID's Support of Intermediaries**

[89] Aidis, et al, p11

[90] DFAT 2020, p.8

[91] The Frontier Capital component was eliminated in light of budget cuts and the emergence of the concept of the Emerging Markets Impact Investment Fund (EMIIF).

[92] Australian Aid, 2020, p.6- The Whistler Principles express a G7 commitment to encourage path-breaking ideas and actions for inclusive and sustainable development that leaves no one behind. Available at https://www.international.gc.ca/world-monde/international_relations-relations_internationales/g7/documents/2018-05-31-whistler-development-developpement.aspx?lang=eng.

Co-Creation	Facilitate collaboration and co-creation across public, private, and civil society sectors
Co-Design	Invest in locally-driven solutions
Applying a Gender Lens to Incubation & Investing	Promote inclusive innovation to have lasting development impact
Adaptive Management	Seize opportunities to learn quickly, iterate and ensure the impact of promising innovations
Complexity Aware Research & Diagnostics	Use evidence, including disaggregated data, to drive decision making
Flexible Funding	Identify scalable solutions, including technologies, that demonstrate high potential

The available evaluations have limitations. As the MEL partners note, the overall MEL report is a performance rather than an impact evaluation. As there were no control groups it cannot be asserted that the observed outcomes in terms of ecosystem change and organisational performance were entirely due to the SFI interventions. The information on which the assessments are based was obtained through surveys of participants and the MEL partners were also participants, rather than completely independent assessors. Table A.1.2 lists some of the performance indicators included in the MEL report – the surveys suggest that the social innovation enterprises and the incubators benefited significantly from the SFI program and that these and other experiences strengthened entrepreneurial ecosystems.

Table A.2.2 Selected SFI Performance Indicators

Increasing the capabilities of social enterprises

- 93% of participating enterprises reported increased relevant knowledge and skills.
- 43% of participating enterprises saw their performance improve.
- A$21 MILLION in additional funding raised

Increasing the capabilities of incubators and accelerators

- 100% of the incubators and accelerators reported increased relevant knowledge/skills.
- 288 social enterprises supported with incubator and accelerator programming.
- 75% of incubators and accelerators reported increased performance.

Challenges and Lessons[93]

Lessons learned for increasing the capability of social enterprises to scale their impact.

- Co-design of support (ie customising technical assistance) and flexible funding are critical to ensuring their relevance.
- Flexible funding should include accountability mechanisms to ensure that decision-making is informed by evidence and that results are tracked and reported, although grantee-reporting should focus most on learning and understanding impact from the grantee perspective.
- Sustainable scaling by social enterprises cannot be achieved if other dimensions of the ecosystem (e.g., access to capital, support services, policy/ enabling environment, human capital, etc.) are constraints – hence direct support should be combined with ecosystem support.

Lessons learned for increasing access to incubation and acceleration services for social enterprises.

- Localising good practices and tools are essential to ensure their relevance and usability.
- Processes to encourage adaptive management throughout implementation are critical to ensure that support meets the evolving needs of incubators and accelerators.
- While incubators and accelerators are uniquely positioned to serve as ecosystem builders, other elements of the entrepreneurial ecosystem (such as people and organisations with knowledge and resources to help entrepreneurs, including access to patient capital and impact investment) also need to be aligned to realise the maximum benefits from this approach.

Lessons learned for improving the effectiveness and efficiency of impact investment deal brokering processes in the Asia-Pacific region

[93] Drawn from Australian Aid, 2020, with a focus on the findings of general relevance.

- Co-creation is an efficient procurement approach to facilitate collaboration across public, private, and civil society and contributes to interventions that are coherent with the existing ecosystem.
- Adaptive management provides an opportunity to learn quickly, iterate and improve the impact of promising innovations.
- Applying a gender lens is critical to ensuring brokering approaches that promote inclusive innovation.
- In general, partnerships are invaluable for delivering informed, coherent solutions to strengthen investment deal brokering processes.
- Technical assistance for social enterprises is needed for investments to be most effective.

Lessons learned for increasing capacity of stakeholders in gender lens investing

- Gender lens incubation and gender lens investing, which are not yet mainstream, require a degree of awareness raising and capacity building to encourage adoption across the Asia-Pacific region.
- Capacity building tools should be designed with stakeholders to ensure relevance and effectiveness of support delivery.
- Donors are well placed to promote the application of a gender lens across all programs to promote inclusive poverty reduction.

Lessons learned for supporting solutions to strengthen connections between innovators, incubators, and brokers

- The networks developed in SFI, and the collaboration among diverse organisations that it enabled, were important for facilitating contributions to ecosystem change.
- Outside of the SFI project, further investment is needed to encourage intermediaries such as incubators and accelerators to work together on entrepreneurial ecosystem building activities.

Overall Recommendations of General Relevance.

- The most effective approach to supporting scaling the development impact of social enterprises is through supporting ecosystem building, particularly through funding for entrepreneurship support organisations such as incubators and accelerators.
- The value of collaboration among the diverse organisations that fund and/or implement entrepreneurial ecosystem strengthening activities was demonstrated through SFI. Such collaborative partnerships should be incorporated into future entrepreneurship and private sector investment programs.
- Ensure, through capacity building, metrics and learning questions, that gender and inclusivity are incorporated into program design.
- Adaptive management, which was a key feature of SFI, should be a 'must have' tool for the measurement and management of aid programs.

This relatively small program (about A$15m over four years), which focused on innovation system strengthening to pursue inclusion and sustainability goals, was innovative in several respects. Notwithstanding the limitations of the evaluations – not independent and without comparators – this is an outstanding exemplar for innovation system strengthening interventions related to entrepreneurship and more broadly.

Sources

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Case Study 3– Platform Technologies – Bio-Earn and Bio-Innovate Africa[94]

Program - Scope and Modalities

Sida has funded The Eastern Africa Regional Programme and Research Network for Biotechnology, Biosafety and Biotechnology Policy Development (Bio-EARN) (1998-2010) and its successor program, Bioresources Innovations Network for Eastern Africa Development (Bio-Innovate Africa) (2010-2021), each with a number of phases, and with total funding of about 350mSEK (approx. USD40m). At the beginning of Bio-EARN the program included Ethiopia, Kenya, Tanzania and Uganda; Burundi and Rwanda were later included. These programs have sought to enhance innovation capacity in order to provide a base for an innovation platform in a new area of science and technology.
Bio-EARN, which was in most respects initially a 'traditional' research capacity building program within the context of a the classic "linear" model of research to use[95], focused on agricultural bioscience and elements of other biotechnology. Importantly, it also included activities to strengthen regional S&T coordination agencies and policy links. The policy capability strengthening aimed to support the countries to make informed decisions about the development and application of biotechnology. BIO-EARN's strategies and initiatives were jointly formulated by partners at national and regional planning meetings. A Program Steering Committee and a Governing Board guided the overall program. Individual projects were developed by researchers from the region.

However, the main focus of investment was formal training for Masters and PhDs and for this purpose the program developed links with regional universities and selected Swedish institutes. Related activities included: annual meetings, training workshops (including in biotechnology-related policy), and provision of some laboratory equipment and research materials and support for greater collaboration among the research organisations. In later phases additional support was introduced to more directly enable the use of the increased research capacity for social and economic value by pursuing the development of technology, technology transfer and relevant policy changes[96].

Bio-Innovate builds on BIO-EARN with a continuation of post-graduate training but with a competitive funding mechanism to support product-oriented biosciences innovation activities and includes the private sector. The focus is on bioresource applications "to support sustainable growth and transformation of the agricultural and environmental sub-sectors from primary production to value addition, while enhancing adaptability to climatic change and strengthening innovation policy"97. The second (2016-2021) phase has a more targeted approach focusing on opportunities that have the capability of delivering value to smallholder farmers and agribusinesses within the next five years. Through project funding and supporting policy analysis and network development, the program aims to enhance the capacity of Eastern African universities, research organisations and firms, to translate modern biosciences into innovations and hence develop a knowledge-based bioeconomy in eastern Africa.

Theory of Change and Innovation System Focus and Objectives

The 2012 evaluation of BIO-EARN concluded that the initial design of was at least implicitly based on the 'linear model' with the overall objective of "science-led economic growth" based on the new platform technology of biotechnology to support a more efficient and sustainable use of natural resources – but lacked an articulated theory of change[98]. As a result, the initial planning did not assess what interventions might be needed to strengthen the innovation systems.

Outcomes and Impacts

While BioEARN significantly improved the availability of trained human resources, it also led to: increased collaboration in technology development and technology transfer partnerships in 15 East African research, development, and policy institutions; increased awareness on key biotechnology policy issues; and, development of bio-safety regulatory structures dialogue between the policymakers and scientists. But according to the evaluation of 2012 did not achieve the planned new

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[94] Rath et al. 2
[95] Rath, et al, 2012b. p3
[96] Rath et al 2012 p78-9; Forsman, Komen, & Virgin, 2011
[97] BioInnovate Africa - Bio-Innovate (bioinnovate-africa.org)
[98] Rath et al 2012 p78-9

product/process outcomes and economic impacts because of the framing and hence design in the "linear view" of research to use [99].

BIOEARN[100]

Outputs and Outcomes	Main Limitations	Other Factors
Improvements in: human resources, publications, regional and international collaboration of 35 research organisations, research infrastructure in 17 labs, applications to plant breeding, biotechnology policy; biotechnology policies and policy capabilities; and links between researchers and policymakers.	Lack of: 'local ownership' of the program; commercialisation of research; marked improvements in the management of research organisations. Evaluation notes a lack of analysis in the program of challenges and 'trade offs' (eg between efficiency and ownership, research versus application), a lack of clarity around innovation and innovation processes and a lack of awareness of the weak local private sector.	More positive outcomes may be evident in the longer term.

Bio- Innovate[101]

Outputs and Outcomes	Main Limitations	Other Factors
Design features: competitive research grants partly based on user/market factors, inter-disciplinarity. Stronger: local ownership; program management; continuous M&E. Outcomes: Phase 1 (2010-2015) new crop varieties; new food products and biopesticides at pilot stage, new wastewater treatment options; 7 PhDs and 38 MScs. Phase 1 (2010-2015)- more focus on commercialisation and on innovation for inclusive growth, particularly for smallholder farmers.	Lack of systematic use of innovation system concepts and indicators in the design of the program: "*Tinkering around the edges on the rules, without clarity on their intended effects,…a cause for concern on likely effectiveness at achieving stated outcomes.*" Possibly under-investment in stakeholder engagement.	Program design requires greater analysis of stakeholder capabilities and interests and further development of the M&E framework. Later phase of the program aims to build the foundation for the transition of the Program to an independent 'platform' for bioscience innovation promotion in East Africa, based on 'buy-in' from local stakeholders.

Challenges and Lessons

1. **Program design and a Theory of Change informed by situational diagnosis**
   The evaluation of Bio-EARN and of the early stage of Bio-Innovate notes the lack of a systematic prior innovation system diagnosis- in the case of Bio-Innovate despite a shift in focus from capacity building to "research for use". This led to underestimating a large number of factors (weak research management skills; university level administrative bottlenecks; procurement issues at participating institutions; the weak local private sector) that led to limited outcomes[102].
2. **Linking a Theory of Change informed by diagnosis to ongoing MEL.**
   Bio-EARN and Bio-Innovate demonstrate a sustained commitment by Sida and also a commitment to using monitoring and evaluation to shape the design of program stages. However, effective learning by all stakeholders is essential. It requires monitoring and evaluation based on a well-articulate ToC and an appropriate set of indicators, understood by all stakeholders. This requires a substantial of investment of resources.

[99] Rath et al. 2012b
[100] Rath et al. 2012b, p.98
[101] Initial assessment by Rath et al. 2012b, p.99, further information from [101] BioInnovate Africa - Bio-Innovate (bioinnovate-africa.org); Forsman,B., Komen, J. Virgin, I., 2011
[102] Rath et al, 2012a, p. 99-100 p. 108-9, p.118

3. **Understanding the muted demand side and questioning the focus on research as a starting point**
   The 2012 evaluation notes the challenges of linking universities with local firms, commenting that: *"Firms tend to first draw on knowledge inputs for their innovative activities from other firms, and only later, as they deepen their own innovative capabilities to include design and technology development, do they begin to interact in significant ways with research organisations."*[103]. *Similarly,* many of the successful projects involved applying and adapting well established knowledge rather than new research[104].
4. **Public-private partnerships**
   All of the evaluations recommend developing links with the private sector earlier in the program. One evaluation of Bio-Innovate emphasised the need for the program to more strongly prioritise "facilitating and supporting strong innovation-driven, user-oriented public-private partnerships ..Moving from a science-driven to a collaborative innovation system model[105].
5. **Complex and difficult trade-offs**
   A lack of clarity in defining who are the owners (of the problems and the program) and their explicit role in program governance contributes to systemic weaknesses. High levels of participation in program design and governance do involve costs in terms of efficiency and there are difficult trade-offs to be developed[106]. Similarly, there are inevitably difficult trade-offs between a range of program objectives, including capacity building and capacity for implementation; demand driven and research excellence; user participation and efficiency.

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Rath et al, 2012b

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Forsman, B., Komen, J. Virgin, I., 2011. A Decade of Bioscience- Development in Eastern Africa: The BIO-EARN Programme 1999–2010. Sida.

Crouch, J. & Bloch, P. 2013. Bio-Innovate Program Mid-Term Review Report. Sida. http://www.sida.se/publications

[103] Rath et al, 2012a, p. 121; Forsman, Komen &Virgin 2011
[104] Rath, et al 2012a, p121.
[105] Crouch, & Bloch, 2013
[106] Rath, et al 2012a, p115.

Case Study 4 Policy Support Programs of Multilateral Agencies

World Bank

The Innovation Policy Platform (IPP)- developed by the World Bank Group and the OECD. An online resource of information, reports and links; and the online module for Self-Paced eLearning Introduction to Innovation Policy for Developing Countries

The Firms, Entrepreneurship and Innovation (ETIFE) unit- reports[107] on key innovation issues (eg include High-Growth Firms; The Innovation Paradox, Trouble in the Making?); provide firm performance and ecosystem diagnostics (determinants (e.g. Kenya, Western Balkans, Mozambique); policy dialogue and advisory work related to firm support policies and institutions- ETIFE has carried out innovation and SME Public Expenditure Reviews in more than 15 countries.

The Africa Region Gender Innovation Lab (GIL) assesses the outcome of development interventions in Sub-Saharan Africa, in order to develop strategies for closing the gender gap in all aspects of development.

OECD

Among the many OECD reports that are widely read by governments are the OECD Reviews of Innovation Policy. These aim to provide a comprehensive assessment of a country's innovation system and offer recommendations for policy innovations. The OECD has carried out such reviews in several LMICs: Kazakhstan 2017; Malaysia 2016; Viet Nam, 2014 (with the World Bank); Colombia 2014; Southeast Asia, 2013; Mexico, 2013 and Peru, 2011.

UNCTAD

Like the OECD and the IDRC, UNCTAD conduct Science, Technology and Innovation Policy Reviews if requested by the national government, and with the objective of stimulating policy debate and change. Reviews have been conducted for several countries, including: Uganda; Ethiopia; and Rwanda. The 2019 update of the framework for these reviews, widened the perspective to include goals of inclusive and environmental sustainability, as well as economic growth, a stronger focus the sustainable development goals (SDGs) a 'more open and experimental outlook on policy-making'[108]. UNCTAD experience suggests that closely linking the reviews to a country's overall development goals contributes to their effectiveness. As does linking a country to a network of STI specialist experts they can draw on in assessing and implementing the review.

UNIDO

One of UNIDO's priorities is to promote inclusive and sustainable industrial development for achieving the SDGs. UNIDO's approach recognises that low innovation rates contribute to low productivity levels and rates of growth and that poorly coordinated innovation systems limit incentives for investment in knowledge and innovation109. UNIDO's technical cooperation program, focused on STI, targets SMEs and aims to identify gaps in technology capability and to develop strategies for addressing them. UNIDO's STI program also in some cases conducts broader NIS reviews[110].

UNIDO's STI group compiles information and reports on SME innovation and productivity performance. It also organises training programs, workshops and conferences to stimulate awareness and share

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[107] World Bank. 2010. Innovation Policy: A Guide for Developing Countries. World Bank.; Cirera, X & Maloney, W.F. The Innovation Paradox Developing-Country Capabilities and the Unrealized Promise of Technological Catch-Up World Bank Tokyo, March 2018; Cirera, X. et al., 2020. A Practitioner's Guide to Innovation Policy : Instruments to Build Firm Capabilities and Accelerate Technological Catch-Up in Developing Countries. Washington, D.C. World Bank Group; Growth Entrepreneurship in Developing Countries: A Preliminary Literature Review. 2016. Washington, DC: The World Bank Group.

[108] See: 22nd Session of the Commission on Science and Technology for Development; UNCTAD, A Framework for Science, Technology and Innovation Policy Reviews. Harnessing Innovation for Sustainable Development. UNCTAD/DTL/STICT/2019/4 - 15 May 2019.

[109] https://www.unido.org/our-focus/advancing-economic-competitiveness/investing-technology-and-innovation/investment-and-technology/science-technology-and-innovation.

[110] UNIDO, 2012. Evidence-Based Policy Making the Ghana National System of Innovation – Measurement, Analysis & Policy Recommendations.

knowledge. For example, it developed a training courses and workshops to build national capacity on science, technology and innovation countries in order to help achieve the Sustainable Development Goals (SDGs)[111].

UNESCO

Under the framework of Science, Technology and Innovation Systems and Governance, UNESCO provides advice to governments on improving their STI systems[112], and training programs[113]. UNESCO activities, often in collaboration with other multi-lateral agencies, include:

- STI policy reviews, under the African Science, Technology and Innovation Policy Initiative, which aims to support the development of STI policies in selected countries, and began in 2007.
- The Capacity Building for STI policy in Africa project, which ran from 2011 to 2014 provided assistance in response to the requests of 21 Sub-Saharan African countries.
- The Support to the development of STI policy instruments in Africa project addresses gaps of the STI systems in four African countries: Equatorial Guinea, Mozambique, Niger and Senegal.
- In collaboration with other agencies UNESCO is providing support to the development of an Arab Science and Technology Plan of Action and a Regional Strategic Action Plan in Science, Technology and Innovation Policy for Latin America and the Caribbean.
- To contribute to these various programs UNESCO has produced a large number of country studies, focused on Science Policy and Capacity-Building114, including: Azerbaijan; Benin; Botswana; Congo; Malawi; Mongolia; Nepal; Nigeria; Tanzania; Zimbabwe.
- UNESCO has established the Global Observatory of Science, Technology and Innovation Policy Instruments (GO-SPIN) to assist countries to address the challenges of addressing the SDGs. This online, open access platform provides information on STI policy instruments and organisation and compiles indicator series that can assist decision-makers115. The Observatory has also produced a number of detailed reports providing analysis and advice at the country level[116].

ADB

The Asian Development Bank also implements projects that aim to provide advice on innovation system strengthening. For example, in Mongolia technical assistance, provided in response to a request, included policy advice and capacity development to strengthen planning and management of the science, technology, and innovation (STI) system.

IDRC

Since 1988, IDRC has funded assessments of STI policies and strategies in 12 countries, including Colombia (1988), South Africa (1992) , China (1995), Vietnam (1997), 2010), Chile (1998), (2008), Jordan (2000) , Mozambique (2005), Honduras (2006), Sri Lanka (2007), Nicaragua (2008) , Panama (2009), and the Philippines (2009). IDRC assessments suggest that many of these policy development and review projects did directly influence policy. In several cases they stimulated the establishment or restructuring of STI organisations. IDRC reports that the value that governments attach to these review reports has often stimulated requests for similar studies by neighbouring countries.

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[111] In collaboration with the UN Inter-agency Task Team (IATT) on STI for the SDGs. The IATT is currently composed of diverse entities, including among others UNCTAD, UNIDO, UNESCO, UNU MERIT, WIPO, UNDESA, UNEP, World Bank, ITU, UNESCWA, UNECA, UNECLAC, UNECE and UNESCAP. The IATT's Work Stream 6 is responsible for capacity building on STI for the SDGs, designing and delivering training courses and workshops on STI policy that target policymakers and key STI managers from developing countries.

[112] Science, Technology and Innovation Systems and Governance. UNESCO has also facilitated the formation of a large number of 'UNESCO Chairs and Centres in Science, Technology and Innovation Policy', although these are not significantly funded by UNESCO.

[113] Training to policy makers in STI policy.

[114] Country Studies | United Nations Educational, Scientific and Cultural Organization (unesco.org); UNESCO's science policy studies series includes studies of innovation systems at the multi-country regional level and reports on specific policy issues: http://www.unesco.org/new/en/natural-sciences/science-technology/prospective-studies/science-policy-studies-series-since-2003/

[115] https://en.unesco.org/sites/default/files/gospin_platform_presentation.pdf

[116] For example: Cambodia, Lao, Guatemala.

Contributing to their success was the fact that the projects were all demand-driven, with the request coming from senior levels of government. However, while policy influence has often been significant, local capacities to develop STI policies often remained weak and hence impacts at this vital level were more muted[117].

The Think Tank Initiative (TTI), which was supported by several donors including IDRC, aimed to strengthen independent policy research institutions (think tanks) in developing countries with the objective of enhancing their ability to inform and influence policy. It was designed in response to awareness that locally generated and grounded research has more influence on policy and can also monitor implementation. Phase I (2009-2012) of the TTI provided support to 50 organisations and an independent review found the program well designed and effective: "*TTI's core grants and capacity-building work have resulted in measurable improvements in the capacity and impact of the supported think tanks. ....The evidence thus indicates that the TTI-funded think tanks are achieving significant impact on policy and practice. In terms of development outcomes, this is an extremely worthwhile investment.*"[118] *p vii*

The policy areas for which the 'think tanks' were relevant varied widely but some were focused on STI policy, for example, Tanzania's Science, Technology and Innovation Policy Research Organization. The evaluation recommended that in a Phase II there should be a greater effort to capture and communicate more widely the lessons of the emerging experience, both of the think tanks and of the initiative to support them.

Phase II of the TTI which provided core funding and advice to 43 policy research organisations in East and West Africa, South Asia, and Latin America, focused on training, exchanging experience with peers, governance, leadership and sustainable financial strategies and management.

Some Other STI and Innovation Policy Support Initiatives

- Sida has supported **Globelics** (The Network for Economics of Learning Innovation and Competence building Systems, initiated by Bengt-Ake Lundvall and Luc Soete in 2002. Globelics has been highly successful in creating a global network of scholars who share an interest in 'systems of innovation and competence building as an analytical framework.
- **The Global Knowledge Initiative** (GKI), an independent organisation supported by USAID, FAO, World Bank, UNIDO and several US foundations also works with governments (and other aid organisations) strengthen science, technology, and innovation (STI) policy and strategy in LLMICs countries. Its work has included external reviews of existing STI policies and provision of advise on pro-innovation policies and strategies.
- Norad, UKAid, UNESCO, UNEP, UNDP, Sida, IDRC, FAO, World Bank, UNIDO and USAID provide support to the **African Centre for Technology Studies** (ACTS), based in Kenya. The Centre undertakes a range of studies in the role of STI in Africa and specific policy issues, and trains researchers and policy makers. It also supports the African Network for the Economics of Learning, Innovation and Competence Building System (Africalics) – the African version of Globalics. Many of these agencies (and several others) also support the African Technology Policy Studies Network (ATPS). The ATPS is a multi-disciplinary network of researchers, private sector actors, policy makers and other actors and aims to promote science, technology and innovation (STI) for African development, environmental sustainability and global inclusion.

Impacts

Innovation has many interpretations and innovation systems are difficult concepts for many outside the field to understand. While there is little doubt that these high level STI/NIS reviews have influenced national policies, there is little available information providing a thorough assessment of the extent to which:

- The country found the analysis comprehensive and useful
- The extent to which the recommendations were implemented

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[117] Voyer, Roger. 2006. A critique of national science, technology and innovation reviews. In Future directions for national reviews of science, technology and innovation in developing countries. eds. Paul Dufour, Foralin Osotimehin. Paris, France.

[118] Young, J. et al, 2013. Final Report of the External Evaluation of the Think Tank Initiative September Overseas Development Institute and European Centre for Development Policy Management. p.v-vii

- Why implementation was successful/limited
- What learning by actors in the country gained from the experience of implementation and post-implementation review
- Whether that learning about implementation issues also contributed to the frameworks for analysis by the international agencies.

Case Study 5 Multi-Level Innovation Support: The Inter-America Development Bank

Scope

With an annual operating budget of about $570m and a capacity to provide an average of $12 billion in lending per year the IADB provides development funding to the countries of Latin America and the Caribbean. The IDB's Competitiveness, Technology and Innovation Division provides technical assistance and loan finance for innovation-related projects in all sectors, but with an emphasis on corporate innovation, STI infrastructure and innovation ecosystems[119]. IDB's projects are developed in response to requests from a country and within the framework of the country-focused programming.

Priorities

In the past the IADB's programs in innovation were focused on productivity improvement and focused on what were seen as market failures. However, IDB's most recent strategy has three priorities: productivity and innovation; social inclusion and equality; and regional economic integration. Technology and innovation are identified as key areas of work for progress in all three priorities, focusing on building institutional capacity in the national innovations systems following internationally recognized best practices, and seeking to tackle clearly identified market or coordination failures[120]. The guiding assumptions for this area of IDBs work are[121]:

- Innovation a key to accelerate development
- Economic growth depends on private sector investment in innovation and new technologies
- Encouraging innovation and productivity in firms that are part of strategic sectors is key to promoting social and economic development
- Technology and innovation are becoming key tools to improve equality and to address the most important social challenges
- A country's ability to adapt and take advantage of technological changes in today's global context depends largely on its entrepreneurs
- Taking full advantage of the opportunities brought by the digital economy requires transforming our productive sectors and business models.

Programs

IDB's innovation-related programs are diverse and include: training in science, technology and innovation for advanced human capital; strengthening scientific and technological infrastructure; designing public policies to promote innovation; and strengthening institutional capacity of the agencies and ministries that are responsible for implementing these policies. The main types of program are shown Table A.1.3

Table A.1.3 Inter-American Development Bank – Innovation-Related Program Types

Type of Program	Examples
Policy studies to influence policies and institutional frameworks[122]	IDB studies and the assessments of innovation policy and performance that it has organised have contributed significantly to policy development in the region. For example: Salazar, J. C.,

[119] Innovation, Science and Technology Sector Framework Document (November 2017)

[120] Nevertheless, the 2017 strategy states: The ultimate goal of public policy in this sector is thus to enhance business productivity and competitiveness in the Latin America and the Caribbean (LAC) region by facilitating the creation and growth of dynamic firms with the capacities and tools to innovate and compete in international markets. Inter-American Development Bank 2017. Innovation, Science and Technology Sector Framework Document- Competitiveness, Technology and Innovation Division IDB

[121] IDB Competitiveness, Technology and **Innovation** Division Competitiveness Technology and Innovation

[122] IDB 2010 Science, Technology, and Innovation in Latin America and the Caribbean A Statistical Compendium of Indicators Inter-American Development Bank Science and Technology Division Social Sector Vice-Presidency for Sectors and Knowledge; Alvarez, Roberto; and Crespi, Gustavo 2019, Innovation in the Global Economy: Opening-Up Latin American Innovation Systems. IDB; Fundación Ecología y Desarrollo; Multilateral Investment Fund, 2016. Study of Social Entrepreneurship and Innovation Ecosystems in the Latin American Pacific Alliance Countries: Case Study: X-runner, Peru. IDB

	2021. Policy Recommendations to Integrate Environmentally Sound Technologies in National Innovation Systems. IDB
Pilot projects and studies	IDB Lab conducts studies and pilot projects, for example, agtech innovations and a survey of women STEM entrepreneurs in LAC[123]
Innovation System Strengthening programs	Innovation systems projects in many countries, eg: Strengthening the National Science, Technology, and Innovation System of Colombia. US$25m loan for institutional development, human resource development, investments in R&D and commercialisation, over 2011-2016.
Entrepreneurial ecosystem development	Support for the development of entrepreneurship ecosystems in different countries, regions and industry sectors, informed by assessments of each particular ecosystem and missing components and connections; promotion of an entrepreneurial culture in the region strengthening incubators, accelerators and the availability of venture capital for innovative entrepreneurs[124]. For example, Colombia: • Support for entrepreneurs and mobilization of capital through angel investors • Development of the Colombian venture capital industry • Leveraging angel investing in Colombia
Strengthening sectoral innovation systems	For example: Agricultural innovation system strengthening in Argentina, including improving agricultural extension services; generating and transferring new technologies.
Social innovation	Since 2007, the Innovation Lab (I-Lab) [125]creates platforms to facilitate links and knowledge exchange based on problems identified by citizens and contributions by knowledge organisations and firms. More generally, the projects support the generation, implementation and dissemination of high-impact social innovations, while involving the beneficiaries in identifying problems, and implementing and scaling solutions[126]. In addition the IDB Lab aims to support private sector innovation with the potential to scale and address inclusion and sustainability goals.
Innovation in Firms	The IDB has an extensive range of programs designed to improve firms' capabilities in innovation-related areas, including improving capabilities in quality management, technology transfer and technology absorption [127].
Digital Transformation	IDB works with governments in designing and implementing digital transformation strategies that foster the adoption and use of digital technologies, the emergence of innovations based on digital technologies and the development of digital business models[128].
Sectoral and Industry Cluster Development	IDB supports programs aiming at strengthening the linkages and collaboration between companies of a certain sector or territory

[123] IDB 2021 Corporate Evaluation. Evaluation of IDB Lab: Strategic Relevance Office of Evaluation and Oversight Inter-American Development Bank. IDB

[124] Fostering Dynamic Entrepreneurship in Countries of the Southern Cone of Latin America: An Analysis of Experiences and Policy Lessons; Business Dynamics and Dynamic Entrepreneurship: Do they Contribute to Employment and Productivity? The Case of Argentina; Connecting the Agents of Entrepreneurial Ecosystems in Latin America and the Caribbean.

[125] The Experience of the IDB's Innovation Lab; How to Promote High-Impact Innovations through Social Innovation Funds: A Call for Public-Private Partnerships

[126] Panama: Innovation Program for Social Inclusion and Productivity

[127] Firm Innovation and Productivity in Latin America and the Caribbean: The Engine of Economic Development

[128] Broadband Policies for Latin America and the Caribbean: A Digital Economy Toolkit; Digital Economy InfoGuide; ICTs in Latin American and the Caribbean Firms: Stylized Facts, Programs and Policies.

	and the participation of companies in national and global value chains[129].
Regional collaboration and learning[130]	Through annual meetings senior government officials have an opportunity for dialogue and exchange of experience regarding national innovation systems, etc. The Regional Policy Dialogue is a key channel for mainstreaming best practices in STI policy. This is extended by the Innovation, Science and Technology of Vice-Ministers and public officials.

As noted the IDB programs are developed within the framework of national strategies. To illustrate this point, Table 2 shows the innovation-related IDB programs in Colombia over 2002-2020.

Table A.1.4 Innovation IDB Projects in Colombia: 2002-2020

Strengthening innovation capacities for the bioeconomy
Promote Productive Development, Innovation and the Creative Economy in Colombia
Support for Policies to Strengthen Scientific and Innovation Capacities within the Framework of COVID-19
Improvement of the System of Public Support to Science, Technology and Private Sector Innovation
Program for the Improvement of Connectivity and Digitalization of the Economy
Market Pull Technology Transfer as a Catalyst for Innovation in Colombia
Strengthening Funding Instruments for Early-Stage Innovative Firms
Sharing Chilean Experience for the National Innovation System in Colombia
Strengthening of Science, Technology and Innovation Policy
Strengthen the National Science, Technology and Innovation System, Phase I
Wireless networks and Digital Inclusion services in the municipality of Guacarí
Instruments and Fund to Promote Science, Technology and Innovation in Colombia
E-Commerce for SME located in Medellin Vulnerable Areas

Evaluations and Learning Outcomes[131]

Despite the identification of 'social inclusion and equality 'among the three priorities, the STI sector framework notes that

> *"..the ultimate goal of public policy in this sector is thus to enhance business productivity and competitiveness in the Latin America and the Caribbean (LAC) region by facilitating the creation and growth of dynamic firms with the capacities and tools to innovate and compete in international markets. Putting together the architecture of scientific, technological, regulatory and connectivity pre-conditions of such enhancement is also a key"*...and it lists the five 'dimensions of success': *"(i) Investment in STI, both public and private, grows so as to reduce the innovation shortage typical of LAC economies, perceptibly reducing the gap between the region and advanced economies; (ii) LAC economies become able to take full advantage of the potential of the digital economy; (iii) LAC economies make observable gains in obtaining the highly skilled human capital necessary to support and further develop their innovation systems; (iv) Public and private investment in technological and scientific infrastructure grows, to a level closer to the one needed to provide the adequate level of inputs for each economy in the region; and (v) The business and innovation climate for private sector development and more intense firm innovation should improve across the region"*[132].

Leadership and coordination. In innovation policy projects, which normally involve a number of public sector agencies, areas the capabilities and leadership of a single executing agency is not sufficient for success-"the sustained ownership of the whole government at the highest levels, as well as a clearly

[129] Crespi, G.; Fernández-Arias, E. & Stein, E. (Eds) (2014). Rethinking Productive Development-Sound Policies and Institutions for Economic Transformation. IDB; Maffioli, A. Pietrobelli, C. and Stucchi, R. (Eds) 2016. The impact evaluation of cluster development programs: methods and practices. Inter-American Development Bank.

[130] Regional Policy Dialogue on Innovation

[131] Navarro, J. C. Benavente, J. M. Crespi, G. 2016. The New Imperative of Innovation Policy Perspectives for Latin America and the Caribbean. Inter-American Development Bank.

[132] Inter-American Development Bank 2017. Innovation, Science and Technology Sector Framework Document-Competitiveness, Technology and Innovation Division IDB, p.1-2.

articulated dialogue and involvement of the private sector".. is essential[133]. However, there has been a tendency to over-estimate the pre-existing coordination capacity among key public and private actors needed to advance a project[134].

The need to make the case for innovation. As most of the outcomes of investments in STI are "..intangible and complex, and are often poorly understood by decision-makers and the public at large" identifying and communicating the benefits that target groups and the society gain is important[135].

Policy capability development. Institutional weaknesses are a serious impediment to effective interventions and innovation policy development. Innovation policy capacity, including policy instrument design, management and evaluation, needs to be developed incrementally to enable human resource development. The IDB's work in "*..impact evaluation and policy research, [has] ..played a critical role in presenting evidence of what works and what does not…the IDB has acted as a catalyst, guiding policy interventions..*"[136]

Strategies for inclusion. There is a trade-off between merit-based policies and diversity and inclusion, as prioritizing excellence can imply less diversity or inclusion. One approach that has been developed is to use targeted requests for proposals (young researchers, regional research institutions, women entrepreneurs), with the objective of identifying and supporting high performance players among socially excluded groups without sacrificing the search for scientific excellence or productivity upgrading in firms. Another approach is using measures to facilitate participation through funding for project preparation and two-stage application processes that create the opportunity for the applicant firms to receive early feedback[137]. Directly address social innovation. "..social innovation programs, using open innovation participatory platforms aimed at finding solutions to issues of social inclusion and poverty reduction, has proved to be a powerful instrument to get larger constituencies interested and involved in STI activities and policies"[138].

Challenges in the strategic focus on inclusion and sustainability[139]. The IDB Lab is the main window through which the IDB supports (through grants, loans and equity investments) private sector innovation (particularly to catalyse new industries and business models that create jobs and improve the productivity of SMEs) with an emphasis on scalable innovations providing opportunities for poor and vulnerable populations[140].The recent evaluation identified two challenges for the Lab. First, its mandate is now broad with three thematic areas (inclusive cities, climate-smart agriculture, and knowledge economy), cross-cutting topics that pertain to gender, diversity, and environmental and social sustainability, and new priorities around technology-based and transformative innovation, as well as support to emerging ecosystems. The result is too much complexity for effective management and also severe difficulties in appropriate criteria for selecting the most promising projects and for ensuring additionality and complementarity with other actors in the LAC innovation ecosystems[141]. Second, the scaling of promising innovations is beyond the scope of the Lab and coordination with other programs is difficult, particularly if they do not have a similar set of priorities.

Implementing organisations and participation. While it is often difficult to find an effective and appropriate local partner for implementation (and the options are often limited), the need for

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[133] IDB, 2017. p.48. This is also likely to improve alignment with national and local development strategy.
[134] IDB, 2017. p.45; but politicians usually lose interest in programs that are 'long terms and not very glamorous': Maffioli, A. Pietrobelli, C. and Stucchi, R. (Eds) 2016. The impact evaluation of cluster development programs: methods and practices. Inter-American Development Bank.
[135] IDB, 2017. p.49
[136] Navarro, J. C. Benavente, J. M. Crespi, G. 2016. The New Imperative of Innovation Policy Perspectives for Latin America and the Caribbean. Inter-American Development Bank. p. 68
[137] IDB, 2017. p.48
[138] IDB, 2017. p.50
[139] Guaipatin, C. et al., 2013. Social innovation : the experience of the IDB's innovation lab Inter-American Development. The Experience of the IDB's Innovation Lab | Publications (iadb.org)
[140] IDB 2021 Corporate Evaluation. Evaluation of IDB Lab: Strategic Relevance Office of Evaluation and Oversight Inter-American Development Bank. IDB. The earlier (2005-2011) evaluation had found that the Lab *had yet to find effective ways to meet its poverty reduction mandate*. The IDB Lab approves about 85 operations each year, with an average investment or grant size of US$1.2m.
[141] IDB, 2021, xii

participatory decision making involving non-state actors tends to discourage some policy makers who prefer policy tools under their control[142].

Effective evaluation. The IDB strategy notes the transition from "from supply-driven support to demand-driven support, then to a systemic approach to the sector"[143]. The IDB approach emphasises pre-project and ex-post evaluation and learning and as a result "*..the IDB has also been instrumental in putting together comprehensive innovation and private sector assessments that have played an important role in shaping policy and institutional reforms in several countries."*[144]
As the range of interventions has widened (to include, for example, value chain upgrading and cluster policies, entrepreneurship development, institutional strengthening, innovation climate) so also has the challenges for effective evaluation. In response to these challenges the IDB has developed new evaluation frameworks[145].

[142] Maffioli, A. Pietrobelli, C. and Stucchi, R. (Eds) 2016. The impact evaluation of cluster development programs: methods and practices. Inter-American Development Bank. p. 193
[143] IDB 2017. p.41
[144] Navarro, J. C. Benavente, J. M. Crespi, G. 2016. The New Imperative of Innovation Policy Perspectives for Latin America and the Caribbean. Inter-American Development Bank. p. 69
[145] IDB, 2011. Evaluating the Impact of Science, Technology and Innovation Programs: A Methodological Toolkit; The Impact Evaluation of Cluster Development Programs: Methods and Practices

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