



Policy and Institutional Frameworks for Science, Technology and Innovation Parks

Proposed Guidelines
for Developing Countries

Technical cooperation outcome



Geneva, 2026

The findings, interpretations and conclusions expressed herein are those of the author(s) and do not necessarily reflect the views of the United Nations or its officials or Member States.

The designations employed and the presentation of material on any map in this work do not imply the expression of any opinion whatsoever on the part of the United Nations concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries.

Mention of any firm or licensed process does not imply the endorsement of the United Nations.

This publication has been edited externally.

UNCTAD/TCS/DTL/INF/2026/1

Acknowledgements

This policy guideline was prepared by Liping Zhang, under the supervision of Angel González Sanz, Officer-in-Charge of the Division on Technology and Logistics of UNCTAD.

UNCTAD gratefully acknowledges the substantive contribution to the policy guideline provided by Rajendra Jagdale, Director General and Chief Executive Officer of Science and Technology Park and Satellite Centre for Policy Research, Pune, India.

The policy guideline was prepared under the UNCTAD project “Science, Technology and Innovation Parks for Sustainable Development: Building Expertise in Policy and Practice in Selected Asian and African Countries”, financed by the 2030 Agenda for Sustainable Development Subfund under the United Nations Peace and Development Fund.

The policy guideline also benefited from contributions made for other outputs generated under the project from Luo Linbo, Associate Professor of China University of Geosciences (Wuhan) and Chief Executive Officer of Zhong-bu-zhi-guang Technology Transfer Company, China; Wang Zhicheng, Chief Executive Officer of Shenzhen CKN Industry Operation Management Company and General Director, Space Techtronic Industries Services (Shenzhen) Company, China; Jakob Lindvall, Senior Adviser, ALDAB Innovation, Sweden; Watcharin (Lhing) Witthayaweerasak, Director of Thai Business Incubators and Science Parks Association, Thailand; and McLean Sibanda, Founder and Chief Executive Officer of Megethos Legacy Catalyst, South Africa.

W. John Rogers edited the document. The cover, overall layout and graphics were carried out by Kathleen Morf. At UNCTAD, Xiahui Xin provided administrative support.



Table of contents

Acknowledgements.....	iii
Acronyms and abbreviations	v
Executive summary	vi
Introduction	viii
I. Key elements of a policy framework conducive to development of STI parks	1
A. Legal recognition for STI parks.....	2
B. Aligning STI parks with the implementation of national development strategies	3
C. Positioning STI parks within the NIS	6
D. Catalysing entrepreneurship development through STI parks	7
E. Fostering clustering for industrial development through STI parks.....	9
F. Designing effective financial support and fiscal incentives	11
G. Incorporating effective non-financial support in the policy framework.....	13
H. Promoting realistic and sustainable business models for STI parks.....	17
II. Key elements of an enabling regulatory framework	19
A. Intellectual property and technology transfer regimes.....	20
B. Innovation-friendly regulation	22
C. Standards and compliance for product safety and quality assurance.....	24
D. Foreign direct investment-related regulations	26
E. Environmental sustainability regulation.....	29
III. Institutional framework for STI parks	31
A. Core principles for governance at STI-park level.....	31
B. Guarantee STI parks' operational autonomy	34
C. Coordination between STI parks and government agencies	36
D. Strengthening linkages and integration with education and research institutions and the private sector	38
E. Fostering public-private partnerships	41
F. Monitoring and evaluation of STI parks through KPIs	43
IV. Assessment of policy effectiveness	47
Annex. Science, technology and innovation park readiness checklist for policymakers	52
Bibliography	55



Acronyms and abbreviations

AI	artificial intelligence
CAPEX	capital expenditure
CEO	chief executive officer
FDI	foreign direct investment
ICT	information and communications technology
IP	intellectual property
KPI	key performance indicator
M&E	monitoring and evaluation
NIS	national innovation system
OPEX	operating expenditure
PPP	public–private partnership
R&D	Research and Development
SME	small and medium-sized enterprise
STI	science, technology and innovation
TTO	technology transfer office
UNCTAD	United Nations Trade and Development



Executive summary

Science, technology and innovation (STI) parks have been developed as a tool to implement STI policies at national and international levels to drive innovation-led sustainable development. They do not exist in isolation but form part of a national innovation system (NIS) linking all aspects of education, research, industrialization, trade, investment and international collaboration. When STI parks are developed and administered properly, they link research and academic institutions with industries, entrepreneurs, investors and governments to facilitate innovations that address national development challenges, support the competitive upgrading of industries, and ultimately strengthen the overall innovation ecosystem of the region that drives regional and national development. However, if the primary focus of an STI park is simply a real-estate or infrastructure development project, the degree to which that STI park supports innovation and development will be substantially limited.

These guidelines, which reflect international experience across diverse economic and institutional contexts, aim to support governments in developing countries in designing and implementing policy, regulatory and institutional frameworks intended to leverage STI parks to drive innovation-led sustainable development. The guidelines are not intended to provide ready-made solutions or recipes for policymakers.

“Science, technology and innovation park” is used in these guidelines as a generic term to cover many types of parks with names such as science park, technology park, innovation hub or district, sectoral or thematic park, incubator, and the like. A successful national STI park strategy often consists of different styles of parks that are designed for specific goals, sectors and regions.

Chapter I explains key elements of a policy framework that will enable an STI park to play its intended role in achieving policy goals. These are:

- **Ensuring** predictability and stability through legal recognition;
- **Positioning** the park as an implementing instrument for STI policies in alignment with national development strategies rather than infrastructure initiatives;
- **Integrating** the park into NISs, industrial policies and regional development frameworks;
- **Catalysing** entrepreneurship, technology transfer and sectoral clustering through the park;
- **Designing** targeted financial and fiscal incentives as well as non-financial support for the STI park;
- **Promoting** sustainable business models and targeted support mechanisms.

Chapter II explains how to address key regulatory dimensions in relation to STI parks, including intellectual property (IP) regimes to promote technology transfer; innovation-friendly regulation, standards and quality assurance; foreign direct investment (FDI) and foreign exchange regulations; and environmental sustainability requirements.



Chapter III provides guidance on how to design an enabling institutional framework in relation to an STI park. It covers:

- Institutional arrangements to enable effective governance and operational autonomy of the park;
- Institutional coordination between the park and government;
- Administrative simplification and facilitation mechanisms;
- STI park linkages with education, research institutions and industry;
- Public-private partnerships (PPPs);
- Monitoring and evaluation (M&E) of the park.

Effective governance is identified as a critical determinant of STI park performance. Governance and institutional arrangements are emphasized as dynamic and context specific, requiring periodic adjustment as STI parks evolve and mature. Chapter III also proposes outcome- and impact-oriented key performance indicators (KPIs) to assess STI park performance, moving beyond narrow input-based or real-estate-based metrics.

Recognizing the long-term and uncertain nature of innovation processes, **Chapter IV** explains how to integrate robust M&E systems into policymaking. M&E systems are framed as tools for learning and adaptive policymaking, enabling governments to refine policy instruments, reallocate resources, and respond to emerging technological and social challenges.

Science, technology and innovation parks, when integrated within innovation and industrial policies as part of national development policy, have a great potential to contribute to national and regional development goals. The gist of these guidelines is that for STI parks to bring about this potential such integration must be deliberate, through policy and institutional frameworks that must not only be well designed, but also adaptive, inclusive and forward-looking. They must be responsive to rapid technological changes, evolving market demands and expectations of diverse stakeholders. Developing an enabling policy and institutional framework for STI parks requires an integrated approach that addresses multiple dimensions of the innovation environment.

The annex contains a readiness checklist in setting up an STI park.





Introduction

Science, technology and innovation parks have become a vital engine of social and economic development by supporting the continuous creation, diffusion and application of knowledge and technologies. The effectiveness of STI parks is primarily shaped by the policy and institutional frameworks within which they operate.

Science, technology, and innovation parks are intermediary entities that typically provide spaces and supporting services in confined geographical areas where multiple technology- or knowledge-intensive organizations (including firms) co-locate to stimulate innovation in research and technology, and commercialize or industrialize the outcomes to promote regional and national development.

There are many forms of STI park structures and their categorization into neatly demarcated boxes is not always possible. These policy guidelines use “STI park” as a generic term to cover all types of innovation-oriented entities. Examples include:

- **Science parks:** Research-driven parks to translate scientific research into innovation, primarily anchored around universities and public research institutions;
- **Technology parks:** Commercialization- or industrialization-focused parks to accelerate technology commercialization, and to bridge research and development (R&D) and market deployment;
- **Innovation parks:** Ecosystem-oriented parks to create dense innovation ecosystems where ideas, talent, capital and enterprises interact continuously;



- **Research and innovation hubs:**

Mission-oriented innovation hubs to address specific national or global challenges focusing on thematic missions, such as health, agriculture, green energy, artificial intelligence (AI), and the like;

- **Industrial innovation parks:**

Manufacturing-linked parks to integrate innovation with production, especially for industrial upgrading.

Sector-specific or thematic parks could be set up under each of the above types of STI parks.

Science, technology and innovation parks have become a vital engine of social and economic development across the world. This is in line with the increasing recognition that outcomes of innovation depend less on individual institutions operating in silos and more on the quality of linkages among various actors enabled by robust innovation systems, namely integrated ecosystems that support the continuous creation, diffusion and application of knowledge and technologies.

Such STI parks provide a space for creating and maintaining innovation systems by orchestrating the interaction among the actors or stakeholders in the innovation systems: government, enterprises, research or academic institutions, and financial intermediaries or investors. Hence, they foster dynamic, interconnected systems for implementation of innovative ideas to address national development and global challenges.

The effectiveness of STI parks is primarily shaped by the policy and institutional frameworks within which they operate. Well-designed policy and institutional frameworks enable these innovation-oriented intermediary organizations to flourish and contribute meaningfully to national and regional development goals. Such frameworks should be aligned with national medium- and long-term innovation strategies that aim to promote regional and national development. Developing an enabling policy and institutional framework

for STI parks requires an integrated approach that addresses multiple dimensions of the innovation environment.

To ensure that STI parks serve as engines of regional and national innovation, policy and institutional frameworks must not only be well conceived but also adaptive, inclusive and forward-looking. They must be responsive to rapid technological change, evolving market demands, and the expectations of diverse stakeholders. Furthermore, policies should foster institutional learning, embed feedback mechanisms, and promote cross-sectoral collaboration to bridge the gaps between research, industry and social outcomes.

Countries that invest in such holistic and dynamic policy and institutional frameworks are better positioned to unlock the full potential of STI parks as catalysts for sustainable economic transformation and other development goals.

These guidelines are aimed at assisting STI park policymakers in developing countries establish policy and institutional frameworks and systems that effectively promote innovation through STI parks. It is not the intention that the guidelines will provide ready-made solutions or recipes for policymakers, but that they will explain specifically, based on international experience across diverse economic and institutional contexts:

- **1. Key elements** of policy and institutional frameworks conducive to STI park development to achieve expected policy goals;
- **2. Assessment** of policy effectiveness.

They are elaborated in four chapters. Chapter I explains key elements of an effective policy framework for STI parks. Chapters II and III address key regulatory and institutional dimensions in relation to STI parks. Finally, Chapter IV shows how to integrate robust M&E systems into policymaking. A checklist of readiness in setting up an STI park is provided in the annex.





Key elements of a policy framework conducive to development of STI parks

STI parks need an enabling policy framework to perform their functions as intended when they are created. This framework usually contains eight elements: legal recognition for STI parks; aligning STI parks with the implementation of national development strategies; positioning STI parks within national innovation system; catalysing entrepreneurship development through STI parks; fostering clustering for industrial development through STI parks; designing effective financial support and fiscal incentives; incorporating effective non-financial support in the policy framework; and promoting realistic and sustainable business models for STI parks.

Often, STI parks perform poorly because they experience chronic difficulties due to various reasons, including: (a) an unclear status and mandate; (b) weak authority to coordinate with the numerous ministries and agents in relation with STI parks; (c) regulatory uncer-

tainty for investors, researchers, universities and enterprises; (d) non-differentiated fiscal or other incentives for different enterprises in different types of STI parks; (e) vulnerability to political changes and budget cuts or power changes in STI park leadership.

The following sections A–H detail the eight elements of an enabling policy framework for STI parks to perform their functions as intended when they are created.

A. Legal recognition for STI parks

Innovation ecosystems require a period of policy stability for a minimum of 10–20 years. A legal status provides an identifiable means of ensuring stability. Hence, granting STI parks explicit legal status through legislation is important or even fundamental in developing countries. It provides not only institutional legitimacy, but also long-term stability and the authority needed to coordinate actors, deploy incentives, and sustain innovation ecosystems over multi-decade horizons.

A robust approach typically involves dedicated legislation or a specific chapter within a national STI act. It consists of the following aspects:

1. Define STI parks and provide a clear public mandate for them to contribute to national development priorities, through activities that include:

- Supporting research–industry collaboration;
- Facilitating technology transfer and commercialization;
- Enabling start-up creation and scale-up.

2. Assign legal personality by establishing STI parks as a legal entity, such as

- A statutory authority; or
- A public interest corporation; or
- An autonomous public agency; or
- A public–private entity with clear public mandate

Legal entity status gives STI parks the ability to enter contracts, hold assets, raise funds, and employ staff.

3. Anchor STI parks within NISs by establishing explicit links between them and the national STI policy, industrial policy, education policy (e.g., science parks), and regional development plans.

4. Clarify rights and permissions – legislation should explicitly allow STI parks to:

- Manage land and facilities;
- Enter contracts, hold assets and employ staff;
- Set admission criteria for tenants;
- Operate incubation and acceleration programmes;
- Enter PPPs;
- Raise funds or receive public funding and private investment;
- Coordinate with regulators and ministries.

5. Protect long-term continuity – legislation should shield parks from short-term political cycles by providing:

- Fixed tenure for governing boards;
- Ring-fenced mandates;
- Clear procedures for amendment or dissolution.

In many developing countries, providing STI parks with an explicit legal basis through legislation and classifying them as entities or organizations of public interest and innovation institutions rather than temporary projects will create predictability, legitimacy and stability. These are factors necessary for long-term innovation investments.

Box I.1 provides some legislative examples.



Box I.1

Legislative examples

In contrast to some countries, for example, Sweden, where parks are created through agreements between municipalities, regional authorities, universities and industry partners, in Asia it is not uncommon to empower an STI park through legislation.

In the Republic of Korea, Daedeok Innopolis has been successfully transformed from a local research cluster into a globally recognized innovation hub. The Special Act on the Support of Daedeok Special Research and Development Zone provides a strong legal framework for innovation within the zone while legitimizing its establishment.

The Law of the People's Republic of China on Scientific and Technological Progress (2021 revision), effective from 1 January 2022, is the legal cornerstone for China's national STI parks. Article 74 stipulates that the State Council may, as appropriate, approve the establishment of science and technology parks such as national high-tech industrial development zones and national innovation demonstration zones, and provide guidance and support for their construction and development, so that they build their own distinctive features and competitive advantages, generate agglomerative or clustering effects and play exemplary or leading roles.

Hong Kong, China established the Hong Kong Science and Technology Parks Corporation Ordinance that governs the creation of STI parks.

Sources: See <https://www.innopolis.or.kr/eng>; https://www.most.gov.cn/xxgk/xinxifenlei/fdzdgknr/fqzc/fifg/202201/t20220118_179043.html; and <https://www.elegislation.gov.hk/hk/cap565>.

B. Aligning STI parks with the implementation of national development strategies

Science, technology and innovation parks have become an instrument intended to advance broader goals, such as:

- Structural transformation;
- Industrial diversification;
- Job creation;
- Regional development;
- Export competitiveness;
- Sustainability and resilience.

Hence, a policy framework for STI parks should be conducive for these parks to perform their intended functions. STI parks fail most often when they are designed as stand-alone innovation projects and disconnected from a country's development

priorities, industrial structure and regional realities.

When STI park policies are not strategically aligned with national and regional development plans:

- Parks attract tenants with no relevance to the local economy but purely for incentives;
- Research outputs do not translate into jobs or industrial upgrading;
- Industrial policy and STI policy work at cross purposes;
- Infrastructure is underutilized and parks become office parks rather than innovation hubs;
- Regional inequalities widen instead of narrowing;
- Political support erodes due to unclear impact and governments struggle to justify sustained public investment.



What does “alignment” mean for STI parks?

Alignment requires an STI park’s operational coherence across **three levels**:

1. Alignment with national development vision;
2. Alignment with the country’s industrial and sectoral strategies;
3. Alignment with regional and territorial development plans.

An STI park should clearly answer three questions:

1. Which national priority does this park serve?
2. Which industries or value chains does it strengthen?
3. Why is this park located in this region?

If these questions cannot be answered clearly, the park will be misaligned.

- Set expected contributions from STI parks, such as more jobs, exports or productivity.

For example:

- If a national plan prioritizes advanced manufacturing → an STI park must support manufacturing-related R&D, prototyping and supplier innovation;
- If a national plan prioritizes digital transformation → an STI park should put emphasis on data, software, AI and digital services.

b. Integrate STI parks into industrial development strategies

Industrial strategies define what a country wants to produce competitively. STI parks define how innovation supports that production. Alignment requires:

- Mapping priority sectors and value chains;
- Identifying where innovation bottlenecks exist;
- Designing STI parks to address those bottlenecks.

Science, technology and innovation parks should strengthen existing or emerging industries. This includes:

- Development and upgrading of suppliers;
- Technology adoption (industry 4.0, clean tech, and the like);
- Product and process innovation;
- Skills and workforce alignment.

c. Align STI parks with regional development and territorial strengths

Regions differ in respect of skills, industrial base, universities and research capacity, infrastructure, and natural and social assets. Alignment requires differentiation based on regional strength.

The following **four steps** will allow STI parks to be aligned with national development strategy and plans:

a. Anchor STI parks in national development frameworks

Policy concerning STI parks should explicitly reference and derive objectives from:

- National development strategies, including green transition and digital transformation plans;
- National STI strategies;
- National industrial policy frameworks.

Anchoring should:

- Define the purpose of setting up STI parks, such as promoting industrial upgrading, innovation-led growth or regional development;

Scenario	Options
a. A region with strong agriculture	a. Set up agri-tech and food innovation parks
b. A region with manufacturing clusters	b. Set up industrial innovation parks
c. A region with medical or biology universities and hospitals	c. Set up life sciences or med-tech parks
d. A region with ports and logistics	d. Set up logistics and trade innovation hubs

Such alignment reduces competition between public parks, and duplication or uneven development among regions.

d. Coordinate ministries and planning instruments

Policy frameworks must mandate:

- Joint planning between science, industry, finance and regional ministries;
- Shared indicators across development, industry and innovation plans;
- Integrated budgeting and implementation.

Alignment cannot happen if:

- STI parks are planned by science and technology ministries alone;
- Industrial policy is isolated from STI policies;
- Regional planning is disconnected.

Box I.2 provides examples of alignment of STI parks with national development strategies.



Box I.2

Examples of aligning STI parks with national development strategies

In the Republic of Korea, the creation of Daedeok Innopolis is aligned with national science and export strategies, which ensures policy coherence, institutional coordination and sustainable funding.

The Cyberjaya Tech Hub in Malaysia was established in alignment with the Malaysia Multimedia Super Corridor Initiative intended to speed up Malaysia's integration into the information and knowledge age and accelerate the growth of the country's economy.

In Singapore, BLOCK71 Singapore established by National University of Singapore Enterprise, Singtel Innov8 and the Singapore Media Development Authority is directly linked to the country's Smart Nation and start-up initiatives.

Sources: <https://www.innopolis.or.kr/eng>; <https://akit.com.my/InvestMalaysia/jp/MSD.htm>; and <https://enterprise.nus.edu.sg>.



C. Positioning STI parks within the NIS

An NIS consists of actors and stakeholders, which include:

- Policymaking bodies (ministries, councils);
- Funding agencies (research councils, innovation funds);
- Knowledge producers (universities, laboratories);
- Knowledge users (enterprises, public sector);
- Technology transfer service providers such as technology transfer offices (TTOs) or firms engaging in professional technology transfer services;
- Regulatory and standards institutions.

Science, technology and innovation parks should be formally recognized as a system integrator and implementation node that connect these actors, hence they should be an integral component of NISs and an execution platform for national STI policy.

Positioning parks within the NIS requires clarity on:

- *Role* (what the park does that other structures do not);
- *Authority* (what the park is empowered to coordinate or implement);
- *Interfaces* (how the park interacts with ministries, funders and institutions).

1. Core roles STI parks could play in implementing national STI policy

a. Translate national STI priorities into operational programmes

National STI policies typically define priority sectors, technology domains, social challenges and long-term goals.

STI parks can:

- Host programmes aligned with STI priorities, including thematic incubators, accelerators or innovation challenges;
- Design applied R&D pilots and commercialization initiatives;
- Translate abstract priorities into projects, facilities and partnerships.

For example:

- If national STI policy prioritizes clean energy → an STI park hosts testing facilities, incubators, start-up accelerators and industry pilots in clean energy;
- If AI is prioritized → an STI park hosts data labs, AI sandboxes,¹ and applied research centres.

b. Act as implementation arms of STI funding agencies

Funding agencies often lack physical infrastructure, proximity to firms and researchers, and capacity to manage pilots and demonstrations. STI parks can act as:

- Hosts for funded projects;
- Platforms for collaborative grants;
- Sites for demonstrators and testbeds.

This requires formal recognition in policy documents and funding rules.

c. Integrate universities, public research and firms

A country's STI policy often emphasizes collaboration, but collaboration does not occur automatically. STI parks provide physical and institutional proximity, shared facilities and services, and neutral spaces for collaboration. Positioning parks as collaboration hubs in the NIS ensures that:

- Public research is absorbed by industry;
- Firms influence applied research agendas;
- Innovation cycles shorten.

¹ The term "sandbox" is used to describe a secure place or environment that provides opportunities for experimentation. The concept of "regulatory sandbox" is defined in chapter II.B.1 ff. Thus, an "AI sandbox" is a test environment for the implementation of AI projects or a secured environment that mitigates security or privacy risks during generative AI exploration.

d. Support STI policy experimentation and learning

National STI policy increasingly relies on pilot programmes, regulatory sandboxes, and adaptive governance. STI parks are ideal environments for:

Testing new policy instruments;

- Testing pilot incentives, grants, or regulatory flexibilities;
- Generating evidence for scaling or redesign of a policy.

This requires explicit policy authorization.

2. Position STI parks within the NIS, step by step

a. Explicit recognition of STI parks in national STI policy

National STI policy should:

- List STI parks as a policy implementation instrument or execution platform;
- Define their role in delivering specific policy objectives;
- Link a park's activities to national indicators and targets.

b. Formal interfaces with STI governance bodies

STI parks should have:

- Representation on national STI and industrial councils or boards;
- Formal reporting lines to STI ministries or agencies;
- Mandated coordination mechanisms with relevant ministries.

This ensures a two-way flow: policy direction guides park programmes and parks provide real-time feedback on what works, informing policy adaptation or adjustment.

3. Align funding flows through STI parks

To enable the orchestrating role of STI parks, public funding could:

- Flow through or be executed within STI parks for relevant programmes;
- Incentivize co-location and collaboration;

- Support shared infrastructure and services.

This embeds parks into the funding architecture of the NIS.

4. Clarify complementary roles to avoid duplication

Science, technology and innovation parks should not replace universities' or research institutes' core research roles, ministries' policymaking roles, or funding agencies' role of funds allocation.

D. Catalysing entrepreneurship development through STI parks

Research or technology alone do not produce jobs, exports and productivity. It is entrepreneurs who take research and add value to it. Often, STI parks fail because they put more focus on providing office space and attracting tenants while failing to create an ecosystem that supports the growth of entrepreneurship.

Entrepreneurship is the main social and economic value that STI parks create. Entrepreneurship development in STI parks should not be assumed but designed.

Catalysing entrepreneurship development goes beyond offering space to start-ups. It requires nurturing throughout a complete entrepreneurial pipeline, covering

- a. idea generation;
- b. venture formation;
- c. early survival and validation;
- d. scaling and market entry; and
- e. integration into value chains.

Science, technology and innovation parks are uniquely positioned to support young or new entrepreneurs throughout this entire pipeline because they combine knowledge, infrastructure, networks and proximity to markets.

To create the desired environment for entrepreneurship development, STI parks should be created as part of an entrepreneurial engine in the overall national innovation ecosystem. Policy frameworks should allow STI parks to:

- Lower entry barriers for new ventures;
- Operate structured incubators and accelerators;
- Access finance and investment, for example, managing government-sourced seed grants and innovation vouchers, partnering with private investors to nurture start-ups and help scale-up, taking minority equity stakes from tenant firms when appropriate and receive performance-based public funding;
- Help with market access and creation of demand for start-ups;
- Build entrepreneurial culture and community.

1. Lower entry barriers for new ventures

Early-stage entrepreneurs face high costs, limited credibility, information gaps and regulatory complexity in compliance. STI parks should be requested to lower these barriers by providing affordable and flexible space, shared laboratories and equipment, common services (such as legal, accounting, IP, regulatory compliance), and administrative facilitation (e.g., permits, registrations).

These allow entrepreneurs to focus on product development and market validation, not survival logistics.

2. Operate structured incubation and acceleration programmes

Entrepreneurship does not emerge spontaneously. STI parks should be advised to host structured programmes such as incubation (from idea to prototype), acceleration (from prototype to market), and pre-commercialization support. These programmes should include business-model

development, customer discovery, regulatory guidance, IP strategy, and financial literacy and budgeting. Crucially, these programmes must be sector specific, aligned with a park's focus.

STI parks should also be advised to actively convert university research achievements, public laboratory outputs, and student and researcher talent into start-ups and spin-offs. This requires a policy framework that has:

- Clear start-up and spin-off policies, which include criteria for them to be admitted and exited from an incubator, criteria to be eligible for government support, and duration for benefiting from government support;
- TTOs required to be embedded in or linked to parks;
- Incentives for researchers and students to commercialize;
- Entrepreneurship leave policies for researchers or professors.

3. Access finance and investment

A core failure factor for start-ups is the financing gap between early-stage ideas and bankable businesses.

STI parks should be requested to:

- Host angel networks and seed funds;
- Provide investor pitch readiness programmes;
- Facilitate co-investment from private investors with public funds;
- Act as trusted deal-flow platforms for investors.

Importantly, parks should not replace investors but reduce information asymmetry and risk.

4. Help with market access and demand creation for start-ups

Entrepreneurship fails without customers. STI parks should be requested to help start-ups access corporate partners, public procurement opportunities, pilot customers, and export and global markets.



This may include:

- Corporate–start-ups matchmaking;
- Living labs and testbeds;
- Government procurement of innovation.

This shifts entrepreneurship from grant dependence to market viability.

5. Build entrepreneurial culture and community

Entrepreneurship is cultural as much as technical. Parks without community programming quickly stagnate. STI parks should be requested to build a community culture for innovation, for example by organizing regular events such as founder networks' events, demo days, hackathons, peer learning, alumni success or entrepreneur-in-residence programmes.

E. Fostering clustering for industrial development through STI parks

Clusters of firms, R&D institutions, skilled labour, service providers, financiers and regulators working together within a common sector (or value chain) has proven to be an effective model for industrial development.

STI parks help create and upgrade clusters thanks to:

- Physical co-location;
- Knowledge generation;
- Technology diffusion and innovation spillover;
- Entrepreneurship support;
- Public policy coordination.

Properly designed, STI parks can act as cluster anchors, accelerating industrial competitiveness and structural transformation.

What does “sectoral cluster development” mean for STI parks?

A sectoral cluster is not just a group of firms operating in the same industry. It includes:

- Lead or anchor companies;
- Small and medium-sized enterprises (SMEs) and specialized suppliers;
- Universities and applied research centres;
- Testing, certification and standards bodies;
- Skilled workforce and training institutions;
- Investors and service providers.

STI parks provide a deliberate spatial and institutional platform where these elements can interact continuously.

To enable STI parks as cluster builders, government policies should:

- Allow sector-specific incentives and incentives for co-location of upstream and downstream actors, such as tax breaks, grants, or subsidized infrastructure;
- Enable differentiated infrastructure investment;
- Provide support to STI parks to attract an anchor firm, such as government grants, location-based incentives and credit facilities for an anchor firm;
- Fund collaborative R&D and pilot programmes;
- Coordinate education, skills and labour policies.

A policy framework could incentivize cluster-building STI parks. In other words, incentives, such as fiscal preferences or

public procurement opportunities, could be tilted towards an STI park that meets the conditions outlined in the following points 1–5.

1. Strategic sector selection and focus

Science, technology and innovation parks should be sector focused (e.g., life sciences, semiconductors, agri-tech); or multi-sector but with clearly defined thematic zones.

Developing countries could promote thematic specialization with flexibility by focusing on high-potential industries and sectors aligned with regional and local strengths and development needs, industry needs and innovation dynamics.² Effective thematic clustering involves evidence-based planning that includes mapping regional competencies, identifying synergies among firms and institutions, and designing park infrastructure that supports these linkages.

Hence, cluster development starts with intentional sector choice aligned with:

- National industrial strategies;
- Existing or emerging comparative advantages;
- Regional capabilities and assets;
- Global market opportunities.

A strong cluster requires focus. Parks that try to “host everything” rarely build depth.

2. Co-location of the full value chain

Co-location enables faster knowledge spillovers, supplier upgrading, joint problem-solving and reduced transaction costs.

STI parks could attract:

- Anchor or lead firms (large companies, public enterprises, global players);
- Tier-1 and tier-2 suppliers;
- Start-ups and spin-offs;
- Applied research and testing facilities.

3. Shared infrastructure and specialized facilities

Sectoral clusters depend on sector-specific infrastructure, such as:

- Clean rooms for semiconductors;
- Wet labs and biobanks for life sciences;
- Pilot plants for chemicals and materials;
- Testing and certification laboratories;
- Digital and data platforms for AI and smart manufacturing.

Science, technology and innovation parks allow these costly assets to be shared across firms, to be publicly co-funded and accessible to SMEs and start-ups. This dramatically lowers entry barriers and accelerates innovation.

4. Cluster-oriented collaboration programmes

Beyond co-location, STI parks must actively orchestrate collaboration through.

STI parks could attract:

- Joint R&D programmes;
- Industry–academia consortiums;
- Supplier development initiatives;
- Standards and interoperability projects;
- Workforce upskilling programmes aligned to cluster needs.

In addition, governance of STI parks should include cluster advisory boards, industry representation, and strong links to national industrial and STI councils.

5. Demand creation and market linkage

Clusters grow when firms have access to lead customers; export markets; and public procurement opportunities. STI parks could facilitate:

- Pilot deployments and living labs;
- Corporate procurement partnerships;

² UNCTAD (2025). *Strengthening Science, Technology and Innovation Parks for Industrial Development through Clustering* (Geneva).

- Government procurement of innovation;
- Export promotion and international partnerships

These ensure clusters are market driven, not subsidy dependent.

F. Designing effective financial support and fiscal incentives

Science, technology and innovation parks host heterogeneous actors with different needs:

- Early-stage start-ups versus mature firms;
- Research institutions versus commercial tenants;
- Capital-intensive sectors versus digital services;
- Domestic SMEs versus multinational R&D centres.

A common policy mistake is to apply generic incentives – blanket tax holidays, uniform subsidies, or undifferentiated grants – to STI parks without regard to the reality indicated in these examples. When financial support is not targeted and differentiated:

- Incentives are wasted on firms that do not need them;
- Start-ups are crowded out by large firms or receive support that is too late or too complex;
- Public funds subsidize low-value activities or real estate instead of innovation;
- Fiscal costs rise without proportional innovation impact;
- Political backlash against park investments grows.

An effective STI park policy framework requires precision instruments that fit into the different types of financial needs within STI parks.

Science, technology and innovation parks typically contain at least four distinct groups, each requiring different instruments – and a single incentive cannot serve them all.

They are:

- Public infrastructure and shared facilities;
- Start-ups and early-stage firms;
- Scaling SMEs and growth-stage firms;
- Anchor firms and multinational R&D centres.

The core principle is that financial and fiscal instruments must be tailored to the life-cycle stage of firms, the sectoral focus of the STI park, and the specific market and innovation failures being addressed.

1. Provide financial support for infrastructure investment, benefiting the entire ecosystem

Infrastructure cannot be financed by tenants alone because of high upfront capital costs (laboratories, clean rooms, pilot plants), long payback periods, and shared facilities with public-good characteristics.

Appropriate instruments include:

- Capital grants and development budgets;
- Concessional loans or development bank finance;
- Public bonds or infrastructure funds;
- Long-term operational subsidies for ecosystem services.

For example, governments may fully fund specialized testing and prototyping facilities while recovering costs through modest usage fees, enabling SMEs to access infrastructure that would otherwise be unaffordable.

2. Provide financial instruments to start-ups and early-stage ventures

Start-ups and early-stage ventures need cash flow for experimentation, proof-of-concept funding, business model validation, and regulatory and IP support. Tax incentives are usually irrelevant to start-ups with no profits. Direct financial support is more effective.

Appropriate policy instruments include.

- Seed grants and proof-of-concept grants;
- Innovation vouchers redeemable within the park, for example, innovation vouchers are offered to start-ups to purchase laboratory time, prototyping services, or IP advice within the park, directly stimulating innovation activity rather than subsidizing rent;
- Public co-investment funds with private angels, venture capital, and the like;
- Grant-equity hybrids.

Principles in designing these instruments include:

- Simple application processes;
- Fast disbursement;
- Milestone-based payments;
- Tied to park-based incubation or acceleration programmes.

3. Provide fiscal and financial support for SMEs and scaling firms

Small and medium-sized enterprises and scaling firms need investment in R&D and technology adoption, workforce upskilling, and market expansion and export readiness. Unlike start-ups, scaling firms respond strongly to predictable, rules-based fiscal incentives.

Appropriate instruments include.

- R&D tax credits – for example SMEs receive enhanced R&D tax credits when participating in joint projects with public research institutions, accelerating technology diffusion;
- Accelerated depreciation for R&D equipment;

- Matching grants for collaborative R&D;
- Soft loans for scale-up and pilot production.

Principles in designing these instruments include:

- Incentives linked to actual R&D or innovation expenditure;
- Higher rates for collaboration with universities or start-ups;
- Sector-specific targeting where relevant.

4. Provide incentives for anchor firms and multinational R&D centres

Anchor firms and multinational R&D centres need long-term certainty, talent access, collaboration opportunities, and protection of IP and data. Large firms do not need subsidies. They need certainty, quality infrastructure, and collaboration incentives.

Appropriate instruments include:

- Conditional tax incentives tied to R&D activities;
- Co-funding of strategic research programmes;
- Support for training and workforce development;
- Fast-track regulatory and administrative services.

Principles in designing these instruments include:

- Performance-based incentives;
- Clear sunset clauses;
- Obligations to collaborate locally.

For example, incentives are granted to multinational R&D centres located in STI parks when they engage in joint research, train local talent, or support start-up ecosystems.

5. Differentiate financial support by sector (e.g., biotech versus software) and a park's maturity (early-stage parks versus established parks)

Differentiation is necessary, because:

- Capital-intensive sectors require higher upfront support;
- Digital sectors benefit more from talent and regulatory flexibility;
- New parks require higher public support than mature ones.

6. Governance and safeguards to avoid misuse of incentives

Such measures include:

- Incentives should be time bound and performance based;
- Clear eligibility criteria must be defined;
- Independent evaluation should be mandatory;
- Incentives should be linked to measurable innovation outcomes.

Governments could ask that STI parks play a screening and monitoring role but that they do not replace fiscal authorities.

G. Incorporating effective non-financial support in the policy framework

Financial incentives alone do not create innovation ecosystems. In many STI parks, firms fail because they face structural and operational barriers.

These may include:

- Limited access to high-quality laboratories or testing facilities;
- Poor digital connectivity or lack of computing capacity;
- Fragmented access to licensing or permits, standards and certifications;
- Inadequate logistics, utilities, or transport infrastructure;
- Weak access to data, platforms and shared services.

Non-financial support – especially infrastructure access and facilitation services – is often the highest-impact, lowest-distortion policy instrument for STI parks. Therefore, a policy framework for STI parks must request that STI parks be designed as infrastructure-enabling platforms, not just as landlords or grant distributors.

Non-financial support includes all interventions that reduce transaction costs, time, uncertainty and coordination failures for innovation actors without direct cash transfers.

This support typically falls into **four broad categories**:

- a. Access to physical infrastructure;
- b. Access to digital infrastructure and data;
- c. Administrative and regulatory facilitation;
- d. Shared services and ecosystem enablers.

1. Easing access to physical infrastructure

Many innovation activities, especially in manufacturing, life sciences, energy, materials, and agri-tech, require specialized, capital-intensive infrastructure that individual firms cannot afford.

Without shared access:

- SMEs and start-ups are excluded;
- R&D remains theoretical;
- Prototyping and piloting are delayed;
- Commercialization stalls.

a. Shared laboratories and testing facilities

STI parks should host or facilitate access to:

- Wet and dry labs;
- Clean rooms;
- Pilot plants;
- Testing and certification facilities;
- Prototyping workshops and maker spaces.

b. Flexible and modular space

Innovation requires adaptability. Rigid and long-term commercial leases often exclude early-stage firms. STI parks should provide:

- Modular laboratory and office spaces;
- Short-term and scalable leases;
- Mixed-use zones (research, light manufacturing, offices).

For example, graduated space models allow start-ups to scale from shared laboratories to dedicated facilities within the same park, reducing relocation risk and disruption.

c. Logistics, utilities, and transport integration

STI parks should ensure:

- Reliable power and water;
- High-quality waste management (especially for laboratories);
- Efficient logistics and freight access;
- Proximity or connectivity to transport hubs.

These elements are often underestimated but critical for industrial innovation.

Policy design principles for access to infrastructure include:

- Public co-funding of infrastructure;
- Neutral access rules;
- Usage-based pricing (not ownership);
- Priority access for start-ups and SMEs.

For example, governments could fund shared prototyping and testing facilities that SMEs could access on a pay-per-use basis, significantly accelerating product development and supplier upgrading.

2. Easing access to digital infrastructure

Today, digital infrastructure is foundational, because across all sectors innovation increasingly depends on high-speed connectivity, data access, computing power and digital platforms for collaboration.

Without robust digital infrastructure:

- AI and data-driven innovation are impossible;
- Remote collaboration is constrained;
- Start-ups face high entry costs

a. Provide STI parks with high-speed connectivity and digital backbone

Parks should be prioritized by the government for:

- High-speed broadband and fibre;
- Redundant connectivity;³
- Secure networks for research and industry collaboration.

They should be treated as essential infrastructure, not a commercial add-on.

³ Redundant connectivity is the practice of maintaining multiple, independent network paths or internet service providers to ensure continuous operation. If the primary connection fails, data traffic automatically reroutes to the backup, preventing downtime. It eliminates single points of failure, crucial for business continuity and reliability.

b. Shared digital platforms and computing resources

Governments can support:

- Shared cloud platforms;
- High-performance computing access;
- Data platforms for research and experimentation.

These resources should be:

- Accessible to start-ups and SMEs;
- Governed with clear data protection rules;
- Integrated with national digital strategies.

Shared computing facilities and cloud credits provided to start-ups working on AI and data-intensive projects significantly lower entry barriers and accelerate experimentation.

c. Access to public and research data

STI parks should act as gateways to data, including:

- Public-sector data;
- Research data sets;
- Environmental, health and industrial data (where appropriate).

Clear data governance frameworks are essential to balance:

- Innovation;
- Privacy;
- Security;
- Public interest.

3. Administrative simplification and facilitation

Administrative simplification and facilitation should be key advantages of STI parks compared to situations where innovative entities are operating in the absence of an STI park structure. Innovation is time sensitive. Start-ups, researchers and foreign investors operating in STI parks face rapid technology cycles, tight funding timelines and competitive global markets. When administrative processes are slow, fragmented or opaque:

- Innovation timelines are disrupted;
- Costs increase disproportionately for SMEs and start-ups;
- Foreign firms perceive high risks;
- Entities within STI parks lose their comparative advantage over those not within an STI park.

Key administrative functions that require simplification and facilitation:

Administrative complexity is one of the most underestimated barriers to STI park success. STI park tenants typically interact with multiple authorities for:

- Business registration and licensing;
- R&D approvals and permits;
- Import and export of equipment and materials;
- IP registration and technology transfer;
- Visas and work permits for talent;
- Tax incentives and fiscal compliance;
- Environmental and safety clearances.

These obstacles can be overcome by establishing a single or one-stop window within an STI park. For example, STI parks can host investment and regulatory facilitation units where firms complete registration, licensing, and incentive approvals through a single coordinated process, significantly reducing time and costs. Or regulators can maintain on-site liaison offices or regular clinics, enabling early guidance and faster resolution of compliance issues.

a. Benefits of one-stop windows for different stakeholders

For start-ups and SMEs:

- Reduced compliance costs;
- Faster market entry;
- Greater focus on innovation.

For foreign firms and investors:

- Predictable establishment timelines;
- Reduced regulatory uncertainty;
- Improved investment confidence.

A one-stop window is not merely an information desk. It is a mechanism that:

- Integrates services across multiple ministries and agencies;
- Provides predictable timelines and procedures;
- Reduces duplication and discretionary decision-making;
- Acts as a single interface for firms, researchers and investors.

The goal is to compress administrative complexity into a single coordinated process.

b. Designing an effective one-stop window for STI parks

i) Institutional anchoring within an STI park

The one-stop window should:

- Be formally present within an STI park;
- Benefit from delegated decision-making powers from relevant ministries and agencies;
- Operate as the primary interface between tenants and relevant ministries and government agencies to avoid duplication and ambiguity over responsibility.

ii) Standardizing procedures and templates

To reduce discretion and increase predictability, administrative simplification and facilitation depend on:

- Pre-approved contract templates;
- Standardized application forms;
- Clear eligibility criteria for incentives and permits;
- Transparent fee structures.

iii) Use digital means to increase efficiency

The administrative agencies involved in the one-stop window should coordinate and establish a uniform digital system on the server of the STI park concerned. This system will not only serve as the platform for applications and approvals and enables real-time tracking of requests, but will also make it possible for all the units to maintain shared databases across agencies and provide clear audit trails.

Digitalization reduces delays and improves accountability. For example, STI parks may operate digital portals that integrate business registration, IP services, visa processing and regulatory approvals, allowing firms to track progress transparently and reducing administrative delays.

iv) Role of the STI park concerned

The STI park operational management body should:

- Coordinate across ministries and agencies;
- Monitor service delivery performance;
- Escalate unresolved issues;⁴
- Continuously refine processes.

⁴ Escalation of an issue or decision is the process of referring to a higher level of management or organizational authority those issues or decisions that cannot be resolved at a certain lower level of authority within an organization. It is an essential process to ensure that decision-making and issue resolution are efficient and effective within organizations.



H. Promoting realistic and sustainable business models for STI parks

The proportion of STI parks that fail do so largely because they are built on unsustainable business assumptions.

Common failures include:

- Expecting parks to become financially self-sufficient too early;
- Over-reliance on land sales or real-estate revenue;
- Treating STI parks as though they were commercial property projects;
- Ignoring long gestation periods of innovation ecosystems;
- Underestimating operating and ecosystem-building costs.

Governments should have a correct perception and reasonable expectation for STI parks and allow them to adopt a realistic and sustainable business model.

The core components of a realistic and sustainable business model for an STI park are detailed in points 1–5.

STI parks are public-interest innovation infrastructures. However, they must still operate on realistic, transparent and disciplined business models to ensure long-term viability and political credibility. A sustainable business model balances public investment, commercial revenue streams, ecosystem value creation and clear accountability.

A realistic STI park business model:

- Accepts long time horizons (10–20 years);
- Differentiates between capital and operating costs;
- Recognizes that not all benefits are monetizable;
- Combines multiple revenue streams;
- Aligns financial sustainability with policy objectives.

1. Clear separation of capital expenditure (CAPEX) and operating expenditure (OPEX)

CAPEX is for:

- Land acquisition;
- Core infrastructure (roads, utilities);
- Research facilities, laboratories, shared equipment;
- Digital infrastructure.

CAPEX is typically publicly funded or financed through development budgets, bonds or long-term concessional finance, and is amortized over decades.

OPEX is for:

- Park management;
- Programme delivery (incubation, acceleration);
- Maintenance and utilities;
- Ecosystem services and events.

OPEX should be partially covered by an STI park's own revenues, and partially supported by recurrent public funding (especially in the early years).

2. Diversified revenue streams instead of land sales or rent alone

Sustainable STI parks use mixed revenue models, such as:

Lease and rental income:

- Office, laboratory and light manufacturing;
- Flexible pricing for start-ups versus mature firms;

Service fees:

- Shared laboratories and equipment;
- Incubation and acceleration programmes;
- Training and certification;

Programme-based funding:

- Public grants for national STI programmes;
- International donor or development partner funding;

Sponsored research and facilities:

- Industry-funded laboratories;
- Corporate R&D partnerships;

Selective equity or revenue participation:

- Minority equity in start-ups;
- Revenue sharing from accelerators (where legally allowed).

3. Phased financial sustainability

Expecting immediate financial break-even is unrealistic. A phased logic must be explicit in a park's policy and budget documents. A credible model will identify the phases:

Phase 1 (0–5 years):

- Heavy public subsidy;
- Focus on ecosystem-building;
- Low occupancy acceptable.

Phase 2 (5–10 years):

- Increasing lease and service income;
- Reduced operational subsidy;
- Growing private participation.

Phase 3 (10+ years):

- Stable occupancy;
- Programme revenues;
- Public funding focused on strategic expansions or missions.

4. Align incentives with innovation outcomes

Business models should reward collaboration, start-up formation, knowledge transfer and cluster development. They should not reward pure rent maximization, exclusion of early-stage firms, or short-term tenant turnover.

This requires:

- Differential pricing;
- Performance-linked public funding;
- Clear innovation KPIs tied to financial support.

5. Build financial disciplines into governance

Science, technology and innovation park governance models should stipulate financial disciplines without drift of missions.

To ensure sustainability, STI parks need:

- Professional financial management;
- Transparent accounting;
- Independent audits;
- Clear rules for reinvestment of surplus;
- Protection from political interference in pricing or tenant selection.





Key elements of an enabling regulatory framework

Regulatory frameworks are key to allowing STI parks to function efficiently and attract tenants. They provide predictability and certainty, protect investments and support innovation processes. Regulation must be balanced between over and under regulation. Overly strict regulations can hinder innovation, while a lack of regulation may create uncertainty and risk. The most successful STI park policies strike this balance by adopting flexible regulations that evolve alongside technological progress.

A regulatory framework that provides an enabling environment for STI parks normally includes:

- IP protection and innovation-friendly regulation that boost innovation and technology transfer;
- Standards and conformity that support R&D and commercialization while ensuring safety and quality;
- Regulation of foreign investment and international cooperation;
- Regulation of environmental sustainability.



A. Intellectual property and technology transfer regimes

Intellectual property rules sit at the heart of innovation and hence are key to STI park effectiveness. They directly determine whether:

- Research translates into products and firms;
- Universities collaborate with industry or remain isolated;
- Researchers engage in commercialization or avoid it;
- Firms invest in joint R&D or rely on internal innovation.

IP rules are unclear, actors avoid collaboration. If IP rules are overly restrictive, innovation is blocked. When IP rules are too fragmented, transaction costs rise. A clear, balanced and predictable IP is therefore essential for technology transfer.

A well-designed regime must simultaneously:

- Protect legitimate IP rights;
- Incentivize researchers to commercialize;
- Encourage firms to collaborate with academia;
- Enable flexible technology transfer pathways;
- Safeguard public interest and follow-on innovation.

1. Clear rules on IP ownership from publicly funded research

In STI parks, where collaboration is widespread, unclear IP ownership hinders collaborative innovation. Ambiguity around IP ownership leads to:

- Delayed negotiations;
- Disputes between universities, researchers and firms;
- Abandoned collaborations;
- Research results remaining unused.

Regulations should clearly state:

- Who owns IP generated from publicly funded research, joint research, or contract research;
- How ownership differs by funding source;
- How rights should be assigned to researchers, institutions and firms.

A widely adopted principle is:

- Institutions own IP;
- Researchers receive defined rights and revenue shares;
- Firms receive access through licensing or joint ownership where justified.

For example, laws stipulating that IP from publicly funded research is owned by universities rather than the State will encourage increased patenting, licensing and start-up creation, because institutions and researchers have clear incentives to commercialize.

2. Empowering TTOs within STI parks

Technology transfer does not happen automatically. It requires:

- Specialized legal and commercial expertise
- Market understanding
- Negotiation capability
- Long-term relationship management.

Regulatory frameworks should:

- Mandate or enable universities and research institutions to establish TTOs;
- Allow shared or centralized TTOs at STI park level;
- Grant TTOs authority to:
 - Negotiate licences;
 - Create spin-offs;
 - Manage IP portfolios;
 - Enter revenue-sharing agreements.

A TTO operating within a park can serve multiple universities and laboratories,



reducing duplication, lowering transaction costs for firms, and professionalizing commercialization activities.

3. Incentivizing academic collaboration with firms

Academics are typically professionally rewarded for publications, teaching and grant awards. Explicit regulatory and institutional incentives are required to encourage their collaboration with firms.

Regulations and institutional rules should allow:

- Recognition of industry collaboration in career progression, that is, joint research, patents and spin-offs should be counted in promotion criteria and tenure rules;
- Revenue sharing: clear rules are required on how licensing income and equity returns are split between researchers, institutions and departments;
- Flexible engagement models, such as consulting, joint appointments, sabbaticals in industry and part-time entrepreneurship;
- Reduced administrative barriers, through, for example, standardized IP agreements and pre-approved contract templates.

4. Flexible IP arrangements for collaborative and contract research

Firms will not collaborate if:

- They cannot access results they co-fund;
- Negotiations are unpredictable;
- Licensing terms are inflexible.

Regulations must allow flexible IP arrangements, such as:

- Joint ownership;
- Field-of-use licensing;
- Exclusive or non-exclusive licences;
- Time-limited exclusivity.

The goal is use of knowledge, not hoarding of IP. Regulatory frameworks should:

- Provide default IP models;
- Allow deviations by agreement;
- Ensure transparency and fairness;
- Protect follow-on research and public interest.

For example, in STI parks orientated towards contract research, firms may be granted exclusive, time-bound licences in specific markets, while universities retain rights for research and non-commercial use, which unlocks collaboration without sacrificing public value.

5. Safeguards for public interest and follow-on innovation

Publicly funded research must serve society and IP regimes must avoid blocking downstream innovation, excessive exclusivity, or knowledge monopolization:

Regulations should include:

- A legal provision (which may be rarely used but is important) that allows the government to grant licences for inventions that have been publicly or government funded to third parties if the patent holder fails to make the technology available to the public on reasonable terms;⁵
- Obligations to exploit IP within a reasonable time frame;
- Retained rights for research and education;
- Provisions for access in public-interest situations (e.g., health, environment).

These safeguards increase legitimacy and political sustainability. Without them:

- Universities avoid industry engagement;
- Firms distrust collaboration;
- IP disputes stall projects;
- STI parks become empty shells;
- Public R&D yields low economic impact.

⁵ An example of such a provision is the "March-in rights" of the United States Bayh-Dole Act of 1980.

B. Innovation-friendly regulation

Innovation is characterized by:

- Uncertainty and experimentation;
- Iterative learning and failure;
- Rapid technological change;
- Business models that do not fit existing rules.

Science, technology and innovation parks feature emerging or frontier technologies and new business models resulting from innovations. When conventional regulation is applied rigidly within STI parks:

- Innovation slows or stops;
- Firms relocate to more permissive jurisdictions;
- Experiments move underground or offshore;
- Regulators lose visibility and learning opportunities.

Innovation-friendly regulation within STI parks should:

- Enable controlled experimentation;
- Reduce regulatory uncertainty for innovators;
- Allow learning by regulators;
- Protect safety, ethics and public interest;
- Provide pathways from pilot to scale.

The most effective instrument to achieve this balance is a regulatory sandbox. Therefore, innovation-friendly regulation is not deregulation. It is adaptive, proportional and learning-oriented regulation that enables experimentation while protecting public interest.

1. Definition of regulatory sandboxes

A regulatory sandbox is a time-bound, supervised regulatory environment that allows firms and researchers to:

- Test new technologies, products, or services;
- Operate under modified or flexible regulatory conditions;
- Generate evidence for future regulation

Within STI parks, sandboxes serve as policy laboratories for emerging technologies.

Why STI parks are ideal locations for sandboxes

STI parks already provide:

- Concentrated innovation activity;
- Access to technical expertise;
- Proximity to regulators and policymakers;
- Controlled environments;
- Institutional governance structures.

Placing sandboxes within STI parks:

- Reduces systemic risk;
- Improves monitoring and learning;
- Encourages responsible experimentation.



2. Types of innovation-friendly regulatory instruments in STI parks

a. Regulatory sandboxes for emerging technologies

For example:

- AI and data-driven services;
- Fintech and digital payments;
- Health and medical technologies;
- Clean energy and mobility;
- Biotechnology and advanced materials.

b. Testbeds and living labs

Beyond formal sandboxes, to allow regulators to observe real-world impacts before full market approval, STI parks can host:

- Real-world testing environments;
- Pilot deployments in controlled settings;
- User-involved experimentation.

For example, an innovation park may host energy storage, smart grid and mobility pilots under modified regulatory conditions, allowing policymakers to understand grid impacts, consumer behaviour, and safety before a nationwide roll-out.

c. Fast-track approval and advisory mechanisms

To reduce uncertainty without lowering standards, innovation-friendly regulation needs to include:

- Early regulatory guidance;
- Pre-application consultations;
- Dedicated regulatory liaison units within STI parks.

3. Designing effective regulatory sandboxes tested within STI parks

To implement a regulatory sandbox effectively within an STI park, regulation should comprise the elements described in (a)–(g).



a. Clear legal basis and mandate

Without legal backing, sandbox outcomes are often challenged or ignored. Sandboxes must be:

- Explicitly authorized in law or regulation;
- Clearly scoped to avoid legal ambiguity;
- Linked to national STI strategies.

b. Defined eligibility and entry criteria

To avoid misuse by firms seeking regulatory arbitrage, participation should be limited to:

- Innovation-oriented activities;
- Technologies with clear uncertainty under existing rules;
- Firms or institutions with credible technical capacity.

c. Time-bound and outcome-oriented design

Permanent sandboxes undermine regulatory credibility. Sandboxes should:

- Operate for a fixed duration;
- Have clear learning objectives;
- Produce evidence for regulatory decisions.

d. Strong oversight and risk management

Innovation-friendly does not mean risk blind. Regulators must:

- Monitor safety, ethics and compliance;
- Require reporting and data sharing;
- Retain powers to intervene or terminate tests.

e. Clear exit pathways

To ensure experimentation leads to systemic improvement, not limbo, each sandbox must define:

- Conditions for full regulatory approval;
- Requirements for scaling;
- Reasons for termination.

f. Role of STI parks

Science, technology and innovation parks should not replace regulators but help regulators reduce coordination costs. They should be assigned to:

- Act as coordinators between innovators and regulators;
- Host sandbox infrastructure and data platforms;
- Ensure compliance with sandbox conditions;
- Facilitate cross-learning among participants.

g. Incentives for participation in regulatory sandboxes

Participation in a sandbox can be made more meaningful when it is associated with:

- Innovation grants;
- Public procurement pilots;
- Accelerated certification pathways.

Results can feed directly into standards development, policy reform and market access decisions.

C. Standards and compliance for product safety and quality assurance

Standards and compliance are critical for STI parks, because innovation without standards does not scale. STI parks exist to move ideas from laboratories to markets. However, products and technologies emerging from STI parks often fail not because they are technically weak, but because they:

- Do not meet safety requirements;
- Cannot be certified for regulated markets;
- Are incompatible with international standards;
- Face delays and uncertainty in approval.

Standards and compliance are therefore market-access infrastructure, not bureaucratic overheads. They must be addressed early and iteratively, not after product development.



In STI parks, standards and compliance involve

- In STI parks, standards and compliance involve:
- Product safety to address health, environmental or technical risks;
- Quality assurance for reliability, performance and consistency;
- Interoperability for compatibility with existing systems;
- Regulatory conformity with national and international rules;
- Certification and accreditation after conformity assessment.

1. Embedding standards into the innovation life cycle

Science, technology and innovation parks should ensure that standards awareness begins at research design, prototyping and pilot testing.

If firms are not made aware of standards as early as possible:

- Prototypes may be non-compliant by design and redesign costs could rise sharply;
- Products may fail regulatory approval;
- Public safety risks increase;
- Time-to-market increases and sales or export opportunities may be missed;
- Investor confidence declines and a park's reputation or credibility decreases.

Regulatory frameworks should require STI parks to:

- Integrate standards guidance into incubation and acceleration programmes;
- Provide early advisory services on applicable standards;
- Encourage "standards-by-design" approaches.

2. Use of international standards to enable market access

Science, technology and innovation parks, especially export-oriented ones, must be orientated towards international standards (e.g., standards set by the International Organization for Standardization, International Electrotechnical Commission, International Telecommunication Union, Codex Alimentarius, among others) because innovation products that comply only with local standards often:

- Cannot be exported;
- Face duplication of testing and certification resulting in delayed entry into foreign markets.
- Regulatory frameworks should:
- Recognize international standards as preferred benchmarks;
- Allow compliance with international standards to satisfy national requirements where appropriate;
- Encourage harmonization rather than national divergence.

3. Access to testing, certification and accreditation infrastructure

Testing and certification facilities are expensive, highly specialized and often centralized in a country's capital or abroad. As a result, SMEs and start-ups face prohibitive costs that can cause extended innovation timelines and missed market opportunities.

Public co-investment is often justified because these facilities serve public safety, enable SME participation and reduce systemic market barriers.

Regulatory frameworks concerning STI parks should:

- Enable establishment of on-site or nearby testing and certification laboratories;
- Allow shared use of accredited facilities.

4. Presence of standards bodies and regulators within STI parks

Standards and regulatory compliance improve when:

- Innovators can consult standards experts early;
- Regulators understand emerging technologies;
- Feedback flows both ways.

Regulatory authorities should:

- Allow standards bodies to operate within STI parks;
- Hold joint workshops with STI parks on evolving standards.

STI parks should be requested to facilitate:

- The presence of standards organizations;
- Dedicated liaison officers from regulators;
- Regular standards and compliance clinics.

This turns compliance into a collaborative process that does not weaken enforcement but strengthens it.

Standards should be seen as innovation enablers,

not constraints. When standards are framed as market access tools, quality signals and trust mechanisms, they become competitive advantages. STI parks should actively promote this perspective through training and mentoring. For example, parks hosting testing and certification facilities may allow SMEs to meet international quality standards, enabling their integration into global supply chains. Guidance from an STI park for standards on data security and interoperability enables start-ups to build globally compatible digital products, avoiding later compliance failures.

D. Foreign direct investment-related regulations

A park created for STI is a strong focal point for innovation-oriented FDI such as R&D centres, design laboratories, advanced manufacturing and global start-ups. Clearly defined and less restrictive market-entry or foreign-exchange rules facilitate FDI entry into STI parks. While FDI regulation must be predictable, transparent and innovation sensitive, national interests, including upgrading local technology capacity through spillover from FDI to local firms, should be protected.

1. Attracting high-quality FDI into STI parks

Frontier technologies, global value chains and knowledge creation are inherently international. FDI, international research collaboration and cross-border partnerships are critical sources of:

- Advanced technologies;
- Managerial and organizational know-how;
- Access to global markets and value chains;
- Capital and scale;
- Standards, certifications and best practices.

High-quality FDI is knowledge intensive, not purely market seeking or cost driven.

a. Position STI parks as globally credible innovation locations

Foreign firms invest in innovation locations when they offer:

- High-quality infrastructure and talent;
- Stable and transparent policy regimes;
- Strong IP protection and data governance;
- Opportunities for collaboration;
- Access to regional and global markets.

Science, technology and innovation parks should be explicitly branded and positioned

as national gateways for innovation-oriented FDI, not generic investment zones.

Policy actions include:

- Designate STI parks as preferred locations for R&D-intensive FDI;
- Align investment promotion agencies with STI park authorities;
- Offer targeted, performance-based incentives for R&D and innovation activities.

b. Market entry regulation for foreign firms

Innovation-oriented FDI needs features to be highly mobile. Foreign firms compare jurisdictions based on:

- Speed of establishment;
- Clarity of rules;
- Ownership flexibility;
- Regulatory certainty.

Foreign direct investment regulations should allow:

- Fast and transparent entry with clear approval timelines, online and single-window processes, and minimal discretionary approvals;
- Flexible ownership structures that allow 100 per cent foreign ownership for R&D and innovation activities where possible while requiring joint ventures where strategic interests apply;
- Clear sectoral rules with explicit lists of permitted, restricted and prohibited sectors while offering special facilitation for STI-focused sectors.

For example, such regulations allow foreign firms establishing R&D centres inside STI parks to benefit from simplified registration and automatic approvals, significantly reducing set-up time compared to general industrial zones.

c. Differentiate incentives for innovation-oriented FDI

Generic investment incentives often attract footloose or low-value activities. FDI regulations in STI parks should offer differentiated incentives, such as:

- Tax incentives conditional on R&D activity;

- Co-funding for joint research programmes;
- Support for training and skills development;
- Fast-track administrative and regulatory services.

Incentives should be time bound, performance based, and linked to collaboration and capability-building locally.

d. Facilitate international research collaboration

In addition to firms, regulation should facilitate STI parks to attract foreign universities and research institutes, international research consortiums, and global technology platforms.

This can be achieved through:

- Hosting joint laboratories and centres of excellence;
- Participating in international research programmes;
- Supporting researcher mobility and exchange.

Such collaborations enhance the park's global connectivity and credibility.

e. Foreign exchange regulations

Innovation activities require:

- Cross-border payments (software, data, equipment);
- International talent compensation;
- R&D collaboration funding;
- Venture capital inflows and exits.

Foreign exchange regulations should hence enable:

- Free inflow of capital for R&D and innovation, such as equity investment, venture capital, and grants and collaborative research funding;
- Operational flexibility, such as payments for international services and licences, cross-border data and cloud services, and equipment and technology imports;
- Predictable repatriation, including profits, royalties and licensing fees, and exit proceeds.



f. Coordination between STI parks and relevant government agencies for FDI

Foreign direct investment policy and regulation are often managed by a country's finance ministry, central bank, ministry of the economy, or investment promotion agency.

Measures to reduce incoordination and the consequences thereof include:

- A dedicated FDI facilitation unit within STI parks;
- Formal liaison by STI parks with investment and foreign exchange regulators;
- Standardized guidance by STI parks for foreign firms;
- Rapid dispute-resolution channels for FDI in STI parks.

g. Safeguards to protect national

Innovation-friendly FDI regulation does not mean absence of safeguards. Safeguards could include measures to protect sensitive technologies, ensure compliance with national security and data rules, and transparency in firms' ownership structures. Safeguards must be clearly defined, proportionate and predictable.

2. Fostering technological spillovers from FDI to local firms

Foreign direct investment alone does not guarantee learning or spillovers. Without deliberate policy and institutional design, STI parks risk having weak linkages to domestic companies and institutions.

The policy challenge is therefore twofold:

- a. Attract high-quality, innovation-oriented international actors to STI parks;
- b. Ensure that their presence generates technological spillovers that upgrade local firms, talent and institutions.

Technological spillovers require absorptive capacity in local firms, structured interaction between foreign and domestic actors, and incentives for collaboration rather than isolation. For example, STI parks linked to

hospitals and universities attract multinational pharma firms. In these cases, collaboration on clinical trials and translational research has created strong knowledge spillovers to domestic biotech start-ups and research institutions. In information and communications technology (ICT)-focused STI parks, foreign firms partner with local start-ups and universities through accelerators, open innovation challenges and talent programmes, accelerating ecosystem learning and global market access.

a. Embed collaboration requirements into FDI policy

Governments can incentivize foreign firms in STI parks to:

- Participate in joint R&D projects;
- Collaborate with local universities and laboratories;
- Engage local SMEs as suppliers or partners;
- Support training and mentorship programmes.

They should be framed as "partnership incentives", not rigid obligations. For example, foreign R&D centres may receive enhanced incentives when they co-fund joint research programmes with local institutions or mentored domestic start-ups.

b. Supplier development and upgrading programmes

Science, technology and innovation parks should be requested to actively facilitate:

- Supplier mapping and matchmaking;
- Quality and standards upgrading programmes;
- Technology adoption and process innovation support.

This enables local SMEs to move from being basic suppliers for foreign invested companies to strategic partners. Such programmes are especially important in manufacturing and technology-intensive sectors.



c. Talent mobility as a spillover channel

People are the most effective carriers of knowledge. FDI regulation should enable:

- Local engineers and researchers to work in foreign firms;
- Training and certification programmes led by multinational enterprises;
- Hosting by STI parks of shared training centres or corporate academies to institutionalize such spillover.

d. Shared infrastructure and open innovation platforms

Spillovers increase when foreign and domestic firms share laboratories, testbeds, digital platforms, standards and certification facilities.

Science, technology and innovation parks should be requested to design shared spaces and programmes that force constructive interaction.

E. Environmental sustainability regulation

Environmental sustainability in STI parks concerns:

- Low-carbon infrastructure and operations;
- Resource efficiency (energy, water, materials);
- Climate resilience;
- Circular economy practices;
- Responsible management of research-related environmental risks.

Modern STI parks must function as demonstration sites for sustainable development, aligning innovation with environmental responsibility. Decisions taken at the design stage should lock in:

- Energy consumption patterns;
- Land and water use;
- Waste generation and emissions;
- Climate resilience or vulnerability.

Regulation must ensure sustainability is designed in, not added as an appendage.

1. Embed environmental standards during the planning and approval of an STI park

Environmental impacts are largely determined at site selection, master planning and infrastructure design.

Science, technology and innovation park regulations should require:

- Mandatory environmental impact assessments at park planning stage;
- Climate risk and resilience assessments;
- Sustainability criteria in park master plans;
- Approval that is conditional on environmental performance benchmarks.

For example, before any construction begins, sustainability assessment is required as part of licensing the creation of an STI park, ensuring low-carbon design, efficient land use and long-term environmental viability. Late-stage regulation can only mitigate, not optimize. Requirements should be predictable and transparent, not discretionary.

2. Low-carbon and energy-efficient infrastructure

Science, technology and innovation parks are energy intensive due to:

- Laboratories and clean rooms;
- Data centres and computing;
- Advanced manufacturing.

Without regulation, energy costs and emissions escalate rapidly. Regulatory frameworks should:

- Mandate energy-efficient building standards;
- Require on-site or nearby renewable energy integration;
- Enable smart grids and energy storage pilots;
- Encourage district-level energy systems.



In parallel, policy incentives should be designed, which may include:

- Faster approvals for green infrastructure;
- Preferential tariffs for clean energy use;
- Access to green finance mechanisms.

3. Water, waste and resource management regulation

Research and innovation activities can consume large volumes of water, generate hazardous and non-hazardous waste, and produce chemical and biological by-products.

Regulations should require:

- Water-efficient systems and reuse where feasible;
- Centralized waste treatment and disposal facilities;
- Clear protocols for hazardous research waste;
- Monitoring and reporting of resource use.

Shared facilities reduce costs and improve compliance for start-ups and SMEs. For example, in life-science and materials parks, mandatory centralized waste and water treatment facilities allow start-ups to meet strict environmental standards without prohibitive individual investments.

4. Promoting circular economy and sustainable innovation

Science, technology and innovation parks are ideal for circular economy practices because they bring together producers, researchers, and system designers and users. This creates opportunities for resource sharing, waste-to-input loops and sustainable product design.

Regulatory authorities could:

- Encourage shared use of materials and equipment;
- Support pilot projects in circular manufacturing;
- Allow regulatory flexibility for circular-economy experimentation;
- Prefer circular solutions in park procurement.

5. Environmental governance and accountability

Sustainability commitments fail without accountability. Regulations should mandate:

- Environmental management systems at park level;
- Regular monitoring and public reporting as transparency strengthens public trust and investor confidence;
- Clear responsibilities for park authorities and tenants;
- Sanctions for non-compliance balanced with corrective support.





Institutional framework for STI parks

An institutional framework for STI parks is essential because STI parks are complex, long-term public innovation institutions, not short-term projects. STI parks often fail when they are treated as project units instead of institutions.

An effective institutional framework provides:

- Clarity of roles and authority;
- Continuity beyond political cycles;
- Accountability for results;
- Coordination across the innovation system;
- Operational autonomy with public oversight.

An institutional framework defines:

- Who governs the STI park;
- Who manages day-to-day operations;
- How decisions are made and enforced;
- How accountability and learning are ensured;
- How the park relates to government, academia and industry.

It answers a simple but critical question: “Who has the authority to do what, and under what rules?”

A. Core principles for governance at STI-park level

An effective governance structure must balance four principles:

- 1. Strategic relevance**, which is informed by industry and research realities;
- 2. Public accountability**, which is the alignment of STI parks’ activities with national goals and public interest;
- 3. Operational efficiency**, which implies fast, professional decision-making;
- 4. Credibility and trust**, which are essential for investors, researchers and partners.

This balance is achieved through multi-layered governance, not a single body.

1. Strategic oversight from a governing body

Good governance provides strategic direction, not operational control or micromanagement. Poor governance leads to political interference, slow decision-making, conflicting priorities and loss of private-sector or investors’ confidence in an STI park.



Set up a governing board

The governing board is the primary strategic decision-making body of an STI park. It governs what the park does, not how it does it. Hence, the governing board should (a) set the park's strategy and sectoral focus and ensure alignment with national policy; (b) approve major programmes and budgets; and (c) appoint the park's operational management leader (e.g., CEO or managing director) and evaluate the management leader's performance. It should not manage day-to-day operations or approve individual tenants or contracts.

The board's composition should be:

- Government (e.g., STI ministry, ministry of industry, ministry of finance);
- Leaders from universities or research institutions;
- Senior industry leaders (especially from priority sectors);
- Independent experts with innovation and commercialization experience.

Industry and academia must be represented as decision makers, not observers. For example, boards include a majority of non-government members from industry and academia, while government retains strategic oversight through chairing or veto rights on public-interest matters.

2. Create advisory bodies whose advice feeds into decision-making (optional but recommended)

These could include sectoral advisory committees, an academic and research council, and an international advisory council.

Types of advisory bodies

- **Sectoral advisory committees** composed of industry experts and leading researchers to guide cluster development in a park;
- **Academic and research councils** to shape research integration and advise on joint laboratories and programmes;
- **International advisory council** to provide global perspective and benchmarks against leading parks in other countries.

Science, technology and innovation parks operate in rapidly changing technological environments. Advisory bodies provide technical depth, market intelligence and future-oriented insight. They provide expertise without diluting the authority of an STI park. However, advisory bodies must have formal channels to influence board decisions. For example, sector-specific advisory committees set up by a park directly inform board-approved cluster strategies, ensuring programmes reflect real industry needs.

Safeguards against capture and conflict of interest

Meaningful involvement of the research and private sectors must not lead to regulatory capture, favouritism or conflicts of interest. The governance framework should include:

- Clear conflict-of-interest rules;
- Disclosure requirements;
- Term limits for board and committee members;
- Transparent decision-making processes.



3. Professional management body and internal organization

Science, technology and innovation parks require skills in innovation programme design, ecosystem-building, technology commercialization, partnership brokering and infrastructure management.

These skills are not typical of real-estate or traditional public administration. Therefore, STI parks should have:

- A professional CEO selected through open, merit-based processes;
- Specialized units for:
 - Innovation and programmes;
 - Partnerships and ecosystem development;
 - Infrastructure and facilities;
 - Finance and compliance.

Ensure programme-level performance

Innovation programmes need industry validation, academic leadership and operational flexibility.

Programme-level management is critical for the success of STI parks.

For major programmes (incubation, acceleration, joint R&D):

- Establish steering committees that include representatives from industry and academia;
- Delegate defined decision powers to programme executors;
- Link programme execution performance to clear outcomes.



4. Accountability, monitoring and institutional learning

Accountability must be built in to STI parks because public trust and long-term support depend on transparency, evidence of impact and learning from failure. STI parks are high risk by nature; accountability must focus on learning and improvement, not punishment.

Institutional frameworks should require for STI parks:

- Annual performance reporting;
- Independent evaluations;
- Clear KPIs linked to national goals;
- Mechanisms to revise a strategy or programmes.prohibitive individual investments.

5. Evolution of governance over a park's life cycle

Governance structures should evolve as the park matures.

Early stage:

- Strong public leadership;
- Heavy academic involvement.

Growth stage:

- Increasing private-sector leadership;
- Strong programme-levels management.

Mature stage:

- Balanced, professional governance;
- Reduced political involvement;
- Strong international advisory input

B. Guarantee STI parks' operational autonomy

Autonomy is essential for STI parks.

Parks operate in environments characterized by:

- Rapid technological change;
- Market uncertainty;
- Iterative experimentation;
- High failure rates alongside high potential returns.

Globally, the strongest predictor of STI park success is operational autonomy combined with public accountability.

Key areas in which an STI park requires autonomy are:

- Hiring and remuneration;
- Contracting and partnerships;
- Programme design and execution;
- Asset and facility management.

Operational autonomy must be defined and safeguarded institutionally

Autonomy means:

- Authority to make operational and programmatic decisions;
- Flexibility in staffing, partnerships and procurement;
- Ability to manage budgets within approved frameworks;
- Freedom to design and adapt innovation programmes.

Autonomy does not mean:

- Absence of oversight;
- Weak accountability;
- Disconnection from national policy;
- Financial irresponsibility.

1. Operational autonomy in day-to-day management

Innovation requires experimentation, speed and iteration.

Park management should be delegated to have authority to:

- Approve tenants and programmes within strategic guidelines;
- Launch, modify or discontinue innovation programmes;
- Enter memorandums of understanding and contracts below defined thresholds;
- Manage shared infrastructure and services.

Boards should oversee strategy and performance, not daily decisions.

2. Financial autonomy with accountability

Without financial autonomy:

- Budget execution is delayed;
- Programmes lose momentum;
- External partners lose confidence.

However, unchecked financial autonomy creates public risk.

Balanced approach

While requiring annual audits, transparent reporting and performance-linked funding reviews, regulatory frameworks should allow:

- Multi-year budget planning;
- Retention and reinvestment of own-source revenues;
- Flexible use of programme funds.

This balance enables agility while protecting public resources. For example, STI park authorities may be allowed to retain leasing and service revenues, reinvesting them into incubation and collaboration programmes, subject to independent audit and board oversight.

3. Human resource autonomy and talent attraction

Science, technology and innovation parks compete globally for:

- Ecosystem builders;
- Programme managers;
- Technology transfer professionals.

Autonomous operations should allow:

- Market-aligned compensation;
- Fixed-term and performance-based contracts;
- Recruitment from industry and academia;
- Rapid hiring for new programmes.

4. Autonomy in partnerships and international engagement

Science, technology and innovation parks must form industry partnerships, university collaborations and international research and innovation links. These partnerships, which are favourable for ecosystem-building, often require fast negotiation, customized arrangements and non-standard agreements.

International collaboration in the STI park context includes:

- Foreign R&D centres and innovation laboratories;
- Multinational enterprises conducting research, design or advanced manufacturing;
- Joint research programmes with foreign universities and institutes;
- Participation in global innovation networks and platforms;
- Cross-border start-up acceleration and scale-up programmes.

Park management should have authority to enter partnerships within board-approved strategy with clear thresholds for approvals set by government. It should be allowed to use standard templates of its own to reduce transaction costs.

5. Safeguards to prevent misuse of autonomy

Autonomy without safeguards risks capture by vested interests, mission drift and financial mismanagement.

Regulatory frameworks must include:

- Clear mandates and performance indicators;
- Board oversight and independent members;
- Conflict-of-interest policies;
- External audits and evaluations;
- Transparent public reporting.

Autonomy works only when paired with credible accountability.

6. Evolution of autonomy over time

Autonomy should be deepened as capacity grows:

Early stage:

- Moderate autonomy with close oversight.

Growth stage:

- Expanded operational and financial autonomy.

Mature stage:

- High autonomy with outcome-based accountability.

Rigid or static autonomy models fail to adapt.

C. Coordination between STI parks and government agencies

Institutional coordination is critical for STI parks' success. STI parks sit at the intersection of multiple policy domains: science, education, industry, finance, trade, environment, digital policy and regional development. No single government agency or ministry controls all the levers required for success.

Without strong institutional coordination:

- Policies conflict or work at cross-purposes;
- Approvals are delayed or duplicated;
- Incentives are misaligned;
- Park authorities lack authority or clarity;
- Firms face regulatory uncertainty.

Institutional coordination is therefore a core structural requirement, not an administrative detail.

Institutional coordination for STI parks means:

- Clear allocation of roles across ministries;
- Mechanisms to align policies, budgets and regulations;
- Predictable decision pathways for park authorities and firms;
- Continuous interaction, not ad-hoc consultation.

It ensures that STI parks function as integrated policy-implementing instruments, not as isolated projects.

1. Government agencies typically involved in STI park development

Effective coordination usually involves

- *Ministry responsible for STI/research:*
 - Policy leadership, strategic alignment, and research and innovation programmes;
- *Ministry of industry/trade:*
 - Industrial clustering, SME development, FDI and value-chain integration;
- *Ministry of education:*
 - Skills development, university and vocational linkages, and talent pipelines;
- *Ministry of finance:*
 - Budget allocations, fiscal incentives and financial oversight;
- *Sectoral ministries* (depending on a park's focus):
 - Health, agriculture, energy, environment, ICT, and the like;
- *Regional or local governments:*
 - Land, infrastructure, local services.

STI parks require formal, institutionalized coordination mechanisms.



Why ad-hoc coordination is not enough

Ad-hoc coordination often fails because it:

- Lacks decision-making authority;
- Depends on individuals rather than institutions;
- Collapses with leadership changes;
- Does not resolve budgetary or regulatory conflicts.

2. Design effective institutional relationships between STI parks and ministries

Science, technology and innovation parks interact with multiple ministries, regulators, universities and research institutions, funding agencies and international partners. Without formal coordination, policies conflict, approvals are delayed, programmes are duplicated, and firms face uncertainty. STI parks should act as implementation arms. For example, STI park governing board members or CEO may participate in national STI coordination councils, ensuring alignment between policy design and on-the-ground implementation.

Governments should establish:

- Formal reporting lines for STI parks to STI or industry ministries;
- Interministerial coordination committees for STI parks;
- Named focal points in key agencies for STI parks;
- Clear escalation and resolution mechanisms for issues arising from STI parks.

a. Designate a lead ministry with clear authority

Coordination fails when “everyone is responsible”. There must be one lead ministry responsible for overall policy

coherence, oversight of STI park authorities, and escalation and resolution of interministerial issues. Other ministries retain their mandates, but coordination flows through the lead. Designating a single ministry to oversee all STI parks, while other ministries participate through formal coordination mechanisms, reduces overlap and policy conflict.

b. Establish a formal interministerial coordination mechanism

The government should create:

- An interministerial committee or council for STI parks;
- A clear legal or policy mandate;
- Regular meeting schedules;
- Defined decision powers.

This interministerial committee or council should:

- Align policies and regulations;
- Coordinate budgetary support;
- Resolve conflicts across ministries;
- Monitor implementation progress.

c. Link coordination to budget and incentives

Coordination is strongest when linked to:

- Joint budget allocations;
- Co-financed programmes;
- Shared performance indicators.

d. Define clear interfaces with STI parks

Science, technology and innovation park authorities (that is, the governing board and operational management body) must know:

- Which ministry to approach for which issue;
- How decisions are escalated;
- What timelines apply.

This requires:

- Named focal points in each ministry;
- Standard operating procedures;
- Single-window coordination mechanisms.

e. Integrate national and regional levels

Many STI parks operate at regional or local levels, while policies affecting STI parks are national.

Effective coordination requires:

- Formal vertical coordination mechanisms;
- Clear division of responsibilities;
- Alignment of national incentives with regional implementation.

3. Coordination with government over the park's life cycle

Institutional coordination is required at all stages, including:

- **Planning stage**, where policy alignment, site selection and sector prioritization are concerned;
- **Establishment stage**, where legal status, funding commitments and regulatory facilitation are concerned;
- **Operational stage**, where programme delivery, incentives administration and FDI facilitation are concerned;
- **Expansion and evolution stage**, where new sectors, international partnerships and regulatory adaptation are concerned.

Coordination must therefore be continuous, not one-off.

For example, STI parks falling under national STI coordination councils chaired at senior government level ensure alignment between science, industry, education and finance ministries. In decentralized systems, national ministries set policy and incentives, while regional governments implement parks through agreed frameworks, avoiding duplication and jurisdictional disputes.

D. Strengthening linkages and integration with education and research institutions and the private sector

Science, technology and innovation parks succeed when they operate as connective tissue between education, research and industry rather than as isolated physical zones. Innovation does not emerge from proximity alone; it emerges from institutionalized collaboration. For example, STI parks closely linked to universities and hospitals enable rapid commercialization of research through co-located laboratories, joint appointments and structured spin-off programmes.

Weak integration leads to:

- Universities or research institutions conducting research with limited relevance to industry;
- Firms unable to access research talent and facilities;
- Graduates lacking industry-ready skills;
- Research commercialization pipelines remaining thin as research is disconnected from markets;
- STI parks becoming rental spaces instead of innovation engines.

Strong linkages are therefore not optional but the core function of an STI park when it is positioned within an NIS. Many STI parks underperform because such integration was assumed, not engineered.





Effective integration requires:

- Shared incentives;
- Joint governance mechanisms with academia and industry being represented at an STI park's governing board or advisory bodies;
- Formal programmes and interfaces;
- Continuous interaction, not episodic collaboration.

Integration must occur across three dimensions:

1. Education (skills and talent);
2. Research (knowledge generation and application);
3. Private sector (markets, scale and demand).

1. Integration with education institutions

Science, technology and innovation parks are long-term assets; their success depends on a continuous pipeline of skilled human

capital. STI parks aligned with technical and vocational institutes develop sector-specific skill pipelines, reducing talent shortages and strengthening local industry.

Without direct integration with education systems:

- Skill mismatches persist;
- Firms recruit externally or offshore;
- Local talent migrates;
- Public investment in education yields limited economic returns

The following points are some mechanisms for integration with education.

a. Alignment and co-design of curricula

Governments could request:

- Formal curricula advisory boards be set up at park level to facilitate an STI park to co-design curricula with universities, technical institutes and vocational bodies that are aligned with the economic sectors within a park;
- Industry is invited to participate in syllabus review so that real industry problems are embedded into coursework and programmes are updated rapidly as technologies evolve;



- Students are encouraged and assisted to undertake credit-bearing industry projects.

For example, degree programmes that have been redesigned to include industry-led capstone projects⁶ hosted within the park result in higher graduate employability and firm satisfaction.

b. Work-based learning and talent pipelines

Government should include STI parks in its hubs for:

- Internships and apprenticeships;
- Cooperative education programmes;
- Industry-sponsored fellowships.

This ensures:

- Early exposure of students to real innovation environments;
- Reduced onboarding costs for firms;
- Stronger retention of local talent.

c. Faculty and researcher mobility

A policy framework for STI parks should enable:

- Sabbaticals for faculty members to work in the sectors within an STI park;
- Industry experts or STI park managers to teach part-time at universities, technical institutes or vocational schools.

2. Integration with research institutions

Public research institutions are major knowledge producers, but without structured pathways research outputs remain unused, IP is underexploited, or public R&D has low social impact.

Science, technology and innovation parks provide institutional and physical platforms for translating research into applications.

STI parks integrating public research institutes directly with manufacturing firms accelerate technology diffusion and supplier upgrading.

The following are some mechanisms to achieve this integration.

a. Co-located research facilities

Parks should be allowed to host university laboratories, applied research centres, and joint industry–academia institutes.

Co-location shortens innovation cycles and builds trust. For example, if research institutes are physically embedded within the park alongside start-ups and pharma firms, translational research and clinical applications are accelerated.

b. Technology transfer and commercialization pathways

Science, technology and innovation parks should be allowed to integrate:

- TTOs;
- Proof-of-concept funding;
- Spin-off creation support.

c. Collaborative research programmes

While parks provide the coordination platform, governments should fund:

- Joint research projects hosted in STI parks;
- Consortiums involving multiple firms and institutions;
- Mission-oriented research aligned with national priorities.

⁶ A “capstone” project is a, normally, final-year assignment integrated into a degree course for which students are asked to identify a real-world problem, analyse the situation, construct a plan to resolve the problem, and then execute it to achieve a solution. The assignment can take the form of research-based projects (the most common); field programmes or internships; portfolio-building; or group projects with several participating students.

3. Integration with industry and the private sector

Firms provide market signals, scale, investment and employment. Without strong private-sector engagement, research agendas drift, start-ups lack customers, or parks lack economic impact.

The following are some mechanisms to achieve integration with industry.

a. Industry-led governance and advisory roles

To ensure relevance of an STI park to industries, a park should be requested to include:

- Industry representatives on governing boards;
- Sector advisory committees;
- Corporate mentors for start-ups.

b. Corporate start-ups collaboration platforms

Parks should be requested to actively facilitate corporate innovation challenges, pilot projects and testbeds, and development programmes for suppliers in a value chain.

These mechanisms turn large firms into demand anchors for start-ups. For example, when large firms are partnered with start-ups to pilot new technologies within the park, adoption and supplier upgrading can be accelerated.

c. Workforce development and upskilling for firms

To support productivity growth and technology adoption, parks should be allowed to host industry training centres, certification programmes and continuous learning platforms.

To enable deep integration, policy frameworks should:

- Mandate joint governance structures;
- Align incentives across education, research and industry;
- Enable flexible contracts and appointments;
- Support shared infrastructure and programmes;
- Measure collaboration outcomes, not just occupancy.

E. Fostering public-private partnerships

Science, technology and innovation parks are capital-intensive, high-risk and long-term undertakings.

They require:

- Significant up-front infrastructure investment;
- Continuous funding for programmes and services;
- Professional operational capabilities;
- Long-time horizons before returns materialize.

Relying solely on public funding often leads to:

- Fiscal strain;
- Underinvestment in quality infrastructure;
- Operational inefficiencies;
- Politicization of management decisions.



Conversely, purely private-led models tend to:

- Prioritize real estate returns over innovation outcomes;
- Underserve start-ups and early-stage firms;
- Underinvest in public-good functions.

Public-private partnerships provide a balanced institutional mechanism to combine public-sector mission and legitimacy on one hand and private-sector capital, efficiency and market discipline on the other.

Public-private partnerships in the context of STI parks participate in infrastructure, funding and operations of the parks. Such partnerships in park infrastructure are not generic infrastructure concessions. They are tailored arrangements that:

- Allocate risk appropriately;
- Align incentives with innovation outcomes;
- Preserve public purpose while leveraging private expertise.

PPPs may apply to infrastructure development, financing, park operations and service delivery, and programme execution.

1. Public-private partnerships for infrastructure development

Park infrastructure involves specialized laboratories, advanced utilities and digital systems, and flexible, high-spec buildings. Public budgets alone often cannot ensure speed of delivery, quality standards and life cycle maintenance.

Common PPP models include build-operate-transfer; design-build-finance-operate; and joint development agreements.

Under these models:

- Private partners finance and construct infrastructure;
- Public partners define standards and long-term objectives;
- Risks are shared based on capacity.

For example, STI park buildings and shared laboratories may be developed through PPPs where private developers finance construction under long-term agreements, while governments ensure affordability and strategic use for innovation activities.

2. Public-private partnerships for funding and financial sustainability

Science, technology and innovation parks require ongoing funding for incubation and acceleration programmes, technology transfer services, shared research facilities, and international collaboration. Public funding alone is often volatile and insufficient.

Public-private partnership funding mechanisms include:

- Co-investment funds for start-ups;
- Innovation vouchers jointly funded by public and private actors;
- Corporate-sponsored research programmes;
- Shared-risk financing instruments.

These mechanisms not only leverage private capital and reduce fiscal burden, but also improve programme relevance. For example, STI parks may operate co-funded innovation programmes where governments provide seed funding and private firms contribute matching funds, ensuring both public interest and market relevance.

3. Public–private partnerships for STI park operations and services

Operating an STI park requires ecosystem management skills, industry networks, commercial skills and service innovation. Public agencies often lack these capabilities internally.

Operational PPP models include:

- Private management contracts under public oversight;
- Joint venture park authorities;
- Outsourced operation of specific services (incubation, laboratories, training).

Under these models, the public sector retains strategic oversight, policy alignment and accountability. For example, private operators will manage incubation and acceleration programmes under performance-based contracts, while the public authority retains control over strategy and evaluation.

4. Risk allocation and governance in PPPs

Poorly designed PPPs lead to cost overruns, compromised infrastructure quality, mission drift, operational inefficiency and erosion of public trust.

Public–private partnerships should:

- Allocate construction risk to private partners;
- Retain strategic and policy risk with the public sector;
- Share demand and revenue risks realistically;
- Include clear performance indicators.

Contracts must explicitly protect:

- Start-up access and affordability;
- Public research integration;
- Long-term innovation objectives.

Under these models, the public sector retains strategic oversight, policy alignment and accountability. For example, private operators will manage incubation and acceleration

programmes under performance-based contracts, while the public authority retains control over strategy and evaluation.

5. Safeguards to preserve public interest

Public–private partnerships in STI parks risk real-estate dominance, exclusion of early-stage innovators and excessive commercialization.

Institutional frameworks should include:

- Clear public-interest clauses;
- Caps on rent escalation;
- Requirements for innovation services;
- Periodic performance reviews;
- Exit and renegotiation mechanisms.

These ensure PPPs remain innovation led, not property led.

6. Evolution of PPPs over the STI park life cycle

Static PPP models fail to adapt to park maturity. PPP roles should evolve:

Early stage:

- Strong public leadership;
- Limited private participation focused on construction of infrastructure.

Growth stage:

- Expanded private role in operations and funding.

Mature stage:

- Sophisticated PPPs for advanced services and expansion.

F. Monitoring and evaluation of STI parks through KPIs

Science, technology and innovation parks are long-term, high-risk public investments. Their outcomes – innovation, firm growth, knowledge spillovers and social impact – are not immediately visible and cannot be assessed using traditional infrastructure or real-estate metrics.



Without a robust M&E framework:

- STI parks drift away from their original mission;
- Performance is judged by inputs (land, buildings) rather than outcomes;
- Public accountability weakens;
- Ineffective programmes persist unchecked;
- Policymakers lose confidence and political support.

Monitoring and evaluation through KPIs provides:

- Evidence of impact and value for money;
- A basis for learning and course correction;
- Transparency and accountability;
- Alignment between policy intent and implementation.

What does “STI park performance” mean?

Park performance refers to how effectively the park:

- Delivers innovation services;
- Builds and sustains an ecosystem;
- Enables firm growth and collaboration;
- Uses public and private resources efficiently;
- Contributes to economic and social outcomes.

Hence, M&E for STI parks goes beyond financial reporting. It involves:

- Tracking innovation performance;
- Measuring ecosystem development;
- Assessing economic and social impact;
- Enabling adaptive management.

KPIs must reflect the multi-dimensional nature of STI parks.

1. Principles for designing KPI frameworks for STI parks

Using a single metric (e.g., occupancy rate) is a structural mistake. Effective KPI systems for STI parks must follow these principles:

- **Outcome oriented** – Focus on results and impacts, not activities;
- **Multi-dimensional** – Cover innovation, economic and social outcomes;
- **Stage sensitive** – Adapt KPIs to the park’s maturity stage;
- **Comparable but contextual** – Allow benchmarking while respecting local context;
- **Actionable** – Inform management and policy decisions.

2. Core KPI dimensions for STI parks

a. *Input and capacity indicators to measure whether foundational capabilities are in place*

- Public and private investment mobilized;
- R&D expenditure within the park;
- Quality and availability of infrastructure;
- Human capital (researchers, engineers, entrepreneurs).

These indicators help assess readiness and scale, not success.

b. *Innovation and knowledge indicators to capture the core innovation function*

- Patents filed and licensed;
- Research publications with industry co-authorship;
- Joint R&D projects;
- Technology readiness-level progression
- New products or processes developed.

These indicators show whether knowledge is being created and applied.

Technology readiness levels

Technology readiness levels (TRLs) are a nine-level metric system evolved from the seven-level system originally developed by the United States National Aeronautics and Space Administration in the 1970s for assessing the maturity of new technologies. It ranges from TRL 1 (basic scientific research) to TRL 9 (a proven system in an operational environment). Originally designed to manage risk in space exploration, this system has provided a consistent framework for evaluating technology readiness across sectors that help with development projects, funding and commercialization decisions.

TRL 1: Basic principles are observed and reported: Scientific or technology research begins;

TRL 2: Technology concept: Practical applications are formulated;

TRL 3: Proof of concept: Critical analytical and experimental functions are demonstrated;

TRL 4: Laboratory validation: Component validation occurs in a laboratory environment;

TRL 5: Relevant environment validation: Components are validated in a relevant environment;

TRL 6: Prototype demonstration: A system/subsystem model or prototype is demonstrated in a relevant environment;

TRL 7: System/subsystem demonstration: Prototype demonstration takes place in an operational environment;

TRL 8: System/subsystem development: Actual system or subsystem is completed and qualified through testing and demonstration;

TRL 9: Proven system: Actual system or subsystem is proven in an operational environment (e.g., full commercial application).

c. Entrepreneurship and firm-level indicators to assess enterprise development

- Number of start-ups created;
- Survival and growth rates;
- Scale-ups graduating from the park;
- Venture capital and private investment attracted;
- Revenue growth of tenant firms.

They demonstrate market relevance and commercial impact.

d. Collaboration and ecosystem indicators to measure integration and spillovers

- University–industry collaborations;
- Corporate–start-up partnerships;
- Supplier linkages and upgrading;
- International partnerships.

Strong ecosystems outperform isolated actors.

e. Economic and social impact indicators to reflect public value

- Jobs created (quality and skill level), particularly for youth and women;
- Contribution to the growth of national or regional priority sectors;
- Exports by tenant firms;
- Environmental and sustainability outcomes;
- Innovation and entrepreneurship nurturing.

These indicators justify public investment. For example, STI park funding is better linked to performance across innovation, entrepreneurship and collaboration indicators rather than occupancy or revenue alone.

3. Designing KPIs across the STI park life cycle

Static KPI systems distort incentives. KPIs must evolve as the park matures, avoiding unrealistic expectations during the early years.

Early stage:

- Infrastructure readiness;
- Partnership formation;
- Programme launch metrics.

Growth stage:

- Start-up survival and growth;
- Research commercialization;
- Investment attraction.

Mature stage:

- Global competitiveness;
- Spillover effects;
- Long-term economic and social impact.

4. Institutional arrangements for M&E

Responsibility for M&E rests with the following:

- STI park authority for primary data collection and internal performance monitoring;
- Lead ministry or coordinating body for oversight and policy alignment;
- Independent evaluators for periodic impact evaluations that help governments redesign programmes and reallocate resources toward higher-impact activities.

Clear roles prevent data manipulation and bias.

How to operationalize M&E

- Define KPIs formally in policy or performance contracts;
- Establish data collection systems early;
- Use digital dashboards for real-time monitoring;
- Conduct annual performance reviews;
- Undertake independent evaluations every 3–5 years.

5. Using KPIs for learning and adaptive management

Innovation involves uncertainty. Not all programmes will succeed. KPIs should be used to:

- Identify what works and what does not;
- Redesign or terminate ineffective initiatives;
- Scale successful programmes;
- Inform policy refinement.

Punitive use of KPIs discourages experimentation.

6. Transparency and accountability

Public reporting of KPI results in:

- Building trust with citizens and investors;
- Strengthening political legitimacy;
- Enabling benchmarking and peer learning.

Transparency should focus on impact, not just numbers.



IV.

Assessment of policy effectiveness

Policy effectiveness assessment ensures that policy intent, instruments and outcomes remain aligned over time. This assessment often examines whether policy instruments deliver outcomes at reasonable cost; whether administrative and regulatory processes are proportionate; and whether public resources are leveraged effectively. Innovation outcomes are uncertain by nature, hence innovation policies should be iterative, agile and adaptable.

Science, technology and innovation parks are not stand-alone initiatives. They are policy instruments designed to implement national STI, industrial, regional and innovation strategies. Measuring the performance of the park alone is insufficient if it does not answer a more fundamental question.

Is the policy framework governing STI parks achieving its intended objectives?

Without systematic assessment of policy effectiveness:

- Governments cannot distinguish between policy design failures and implementation failures;



- Ineffective or outdated policy instruments persist;
- Resources are allocated based on assumptions rather than evidence;
- STI parks are blamed for outcomes beyond their control.

Policy effectiveness assessment ensures that policy intent, instruments and outcomes remain aligned over time. This assessment focuses on policy performance, not merely operational efficiency.

What does “policy effectiveness” mean with respect to STI parks?

Policy effectiveness refers to the extent to which:

- STI park-related policies achieve their stated objectives;
- Policy instruments (funding, incentives, regulation, governance) function as intended;
- Outcomes observed in STI parks can be credibly linked to policy intervention.

1. Clarifying policy objectives and theory of change

Policy effectiveness cannot be assessed unless objectives are explicit.

Governments must clearly articulate:

- What problems STI park policy is intended to solve;
- What outcomes are expected in the short, medium and long term;
- How STI parks are expected to contribute to national goals.

This is often formalized through a theory of change, linking:

- Inputs → activities → outputs → outcomes → impacts.

Without this clarity, evaluation becomes arbitrary.

2. Linking KPIs to policy objectives

Key performance indicators that are disconnected from policy objectives provide misleading signals.

Indicators must be explicitly mapped to:

- Policy goals (e.g., innovation capacity, industrial upgrading, job creation);
- Specific policy instruments (e.g., incentives, governance reforms, PPPs).

This enables policymakers to assess:

- Whether observed outcomes reflect policy success;
- Whether underperformance is due to weak policy design or weak execution.

3. Dimensions of policy effectiveness assessment

a. Relevance

Public and private investment mobilized;

- Addresses current national and regional priorities;
- Responds to evolving technological and market conditions;
- Remains aligned with broader STI and industrial strategies.

A policy may be well implemented but no longer relevant.

b. Effectiveness

Assesses whether STI park policy:

- Achieves intended outcomes;
- Produces measurable innovation, economic and social benefits;
- Contributes meaningfully to national STI goals.

This focuses on results, not activities.

c. Efficiency

Assesses whether:

- Policy instruments deliver outcomes at reasonable cost;
- Administrative and regulatory processes are proportionate;
- Public resources are leveraged effectively.

Inefficient policies weaken political sustainability.

d. Coherence

Assesses alignment between:

- STI park policy and other policies (education, industry, FDI, environment);
- National and regional policy frameworks;
- Policy objectives and regulatory constraints.

Lack of coherence is a common cause of underperformance.

e. Additionality

Assesses whether:

- Outcomes would have occurred without the policy;
- STI park interventions correct market or system failures;
- Public support crowds in, rather than crowds out, private activity.

This is critical for justifying public investment.

4. Methods for assessing policy effectiveness

a. Quantitative analysis that can show scale and comparability

This includes:

- Trend analysis of KPIs before and after policy interventions;
- Benchmarking against comparable parks or regions;
- Cost-benefit and cost-effectiveness analysis.

b. Qualitative analysis that can explain why outcomes occur

This includes:

- Stakeholder interviews and surveys;
- Case studies of firms, collaborations and programmes;
- Expert panels and peer reviews.

c. Counterfactual approaches (where feasible) that strengthen causal interpretation

Where data allows:

- Compare STI park outcomes with similar non-park contexts;
- Use phased roll-outs or pilot programmes to infer impact.

5. Institutional responsibilities for policy effectiveness assessment

Clear separation of roles is essential:

- STI park operational management body provides data and operational insights;
- Lead ministry or coordinating body assesses policy performance and proposes policy adjustments;
- Independent evaluators conduct periodic effectiveness reviews and ensure objectivity and credibility.

Assessment should inform policy revision, not blame. For example, STI park policies could be reviewed every few years to assess alignment with national innovation and industrial strategies, leading to recalibration of incentives and governance structures. Governments could explicitly link STI park KPIs to policy objectives such as SME upgrading or research commercialization, enabling clear assessment of policy effectiveness rather than park activity alone.

When policy effectiveness is not assessed:

- Ineffective policies persist;
- Successful instruments are not scaled;
- STI parks operate under outdated rules;



- Political and public support erodes;
- Learning across regions and parks is lost.

Policy stagnation often masquerades as implementation failure.

6. Agile, dynamic and adaptive policymaking

STI parks operate in environments defined by:

- Rapid technological change;
- Uncertain innovation trajectories;
- Shifting market and societal needs;
- Emerging risks and opportunities.

When STI park policy is static:

- Regulatory frameworks lag behind technology;
- Incentives become misaligned with market reality;
- Promising new sectors remain unsupported;
- Public resources are locked into outdated priorities.

Agile, dynamic and adaptive policymaking ensures that STI park policy evolves with evidence. Agility is a governance capability, not an ad-hoc response.

a. Embedding learning into policy design

Innovation outcomes are uncertain by nature. Policies must assume:

- Some instruments will underperform;
- Some priorities will need revision;
- New opportunities will emerge unexpectedly.

Governments should:

- Explicitly include learning objectives in STI park policies;
- Define review points at policy design stage;
- Allow policy instruments to be modified without full legislative overhaul.

This turns policy from a static rulebook into a living framework.

b. Using M&E as a feedback engine

Key performance indicators and evaluations are of no use unless they:

- Inform decision-making;
- Trigger policy adjustment.

In adaptive systems, M&E is not retrospective reporting, it is forward-looking guidance.

What does agile and adaptive policymaking mean?

Agile policymaking does **NOT** mean policy instability or constant change. It means:

- Policies are designed to learn and adjust;
- Decisions are informed by real-time evidence;
- Small-scale experimentation precedes large-scale roll-out;
- Feedback loops are institutionalized.

How can M&E be operationalized?

- Use KPI dashboards for continuous monitoring;
- Conduct regular performance and policy reviews;
- Link evaluation findings to:
 - Budget reallocations;
 - Programme redesign;
 - Regulatory adjustments.

Feedback loops must be formalized, not discretionary.

c. Pilots, sandboxes and policy experimentation

Large-scale policy mistakes are costly and politically difficult to reverse.

STI parks provide ideal environments for:

- Testing new incentives;
- Trailing regulatory approaches;
- Piloting governance models.

Adaptive policy frameworks should:

- Encourage pilot programmes within STI parks;
- Use regulatory sandboxes for emerging technologies;
- Define clear criteria for scaling or termination.

Experimentation reduces risk while increasing policy intelligence.

d. Flexible policy instruments and modular design

Policies designed as rigid, bundled instruments are difficult to adapt.

Governments should:

- Use modular policy instruments that can be adjusted independently;
- Separate strategic goals from operational tools;
- Allow differentiated instruments for different parks or sectors

This enables fine-tuning without destabilizing the system.

e. Institutional arrangements for adaptive policymaking

Adaptive policy fails without institutional capacity. Adaptive policymaking is as much about capability as intent.

Required institutional features include:

- Clear authority to revise instruments;
- Cross-ministerial coordination mechanisms;
- Capacity within ministries and park authorities to analyse data;
- Regular dialogue between policymakers and implementers.

f. Managing political and institutional risk

Agility can be misinterpreted as inconsistency.

To address such concern, governments should:

- Anchor adaptive processes in formal review cycles;
- Communicate clearly why changes are made;
- Maintain transparency in decision-making;
- Preserve core policy objectives while adjusting instruments.

Stability of purpose must coexist with flexibility of means. For example, STI parks can be used to pilot new innovation incentives and regulatory approaches before scaling them nationally, reducing policy risk and improving design quality. Funding allocations to STI parks should be adjusted periodically based on performance data and emerging priorities, ensuring resources follow impact rather than precedent.



Annex

Science, technology and innovation park readiness checklist for policymakers

This checklist helps governments assess whether an STI park proposal (new or existing) is strategically justified, institutionally sound, financially viable and ready to implement.

A park that fails multiple checks **should not proceed** until gaps are addressed.

1. Strategic and policy alignment

- ☐ Is the STI park explicitly aligned with the national STI policy?
- ☐ Is it linked to national development and industrial strategies (not stand-alone)?
- ☐ Are priority sectors clearly defined and justified by:
 - Existing capabilities?
 - Future comparative advantage?
 - Global demand?
- ☐ Is the park's role in the NIS clearly stated (implementation platform, cluster anchor, testbed, and the like)?

 *Park is justified mainly by land availability or political visibility.*

2. Legal and institutional readiness

- ☐ Does the STI park have clear legal status specified in a law, regulation, policy document or government administrative decision?

- ☐ Is its mandate clearly differentiated from:
 - Industrial estates?
 - Special economic zones?
 - Universities?
- ☐ Are powers defined to:
 - Manage land and facilities?
 - Run incubation/acceleration programmes?
 - Partner with private and international actors?
 - Manage shared infrastructure?
- ☐ Are governance bodies legally established with defined roles?

 *Park is created only through administrative orders or project notifications.*

3. Governance and coordination

- ☐ Is there a clear governance structure (board, management, advisory bodies)?
- ☐ Are industry, academia and public agencies represented meaningfully (not symbolically)?
- ☐ Are reporting lines to national STI and industrial policy bodies defined?
- ☐ Is there a mechanism for interministerial coordination?
- ☐ Are decision-making powers delegated enough to avoid bureaucratic delays?

 *Park management has responsibility without authority.*

4. Financial and business model viability

- ☐ Is there a clear separation between CAPEX and OPEX?
- ☐ Is public funding committed for:
 - Core infrastructure?
 - Early-stage operations?
 - Ecosystem services?
- ☐ Are revenue streams diversified (not land sale dependent)?
- ☐ Is there a phased sustainability plan (0–5, 5–10, 10+ years)?
- ☐ Are financial projections realistic (not politically optimistic)?

 *Expectation of financial self-sufficiency is in <5 years.*

5. Infrastructure readiness

- ☐ Is sector-specific physical infrastructure planned (laboratories, pilot plants, testing)?
- ☐ Are facilities designed for shared access (especially for SMEs/start-ups)?
- ☐ Is high-quality digital infrastructure guaranteed (connectivity, data, computing)?
- ☐ Are utilities, logistics and waste management adequate for R&D activities?

 *Generic office buildings are labelled as “innovation infrastructure”.*

6. Entrepreneurship and SME support capacity

- ☐ Are incubation and acceleration programmes clearly defined?
- ☐ Is there access to:
 - Proof-of-concept funding?
 - Mentoring?
 - Investor networks?
- ☐ Are IP, legal and business services available at park level?
- ☐ Are entry barriers deliberately lowered for start-ups?

 *Park assumes start-ups will “come automatically”.*

7. Research and education integration

- ☐ Are universities and research institutions formally integrated?
- ☐ Are joint laboratories, programmes or appointments planned?
- ☐ Are curricula, internships and skill pipelines aligned to park sectors?
- ☐ Are technology transfer mechanisms functional?

 *Universities are nearby but not institutionally linked.*

8. Private sector and cluster development

- ☐ Are anchor firms identified or targeted?
- ☐ Are supplier development and cluster programmes planned?
- ☐ Are collaboration platforms (consortiums, pilots) designed?
- ☐ Are demand-side instruments (procurement, pilots) considered?

 *Tenant mix is driven by occupancy, not strategic relevance.*

9. Internationalization and FDI strategy

- ☐ Is there a clear strategy to attract innovation-oriented FDI?
- ☐ Are incentives conditional on collaboration and spillovers?
- ☐ Are mechanisms in place for:
 - Supplier upgrading?
 - Talent mobility?
 - Joint R&D?
- ☐ Is the park connected to global innovation networks?

 *FDI is treated as real-estate occupancy.*

10. Monitoring, learning and adaptability

- ☐ Are KPIs defined beyond occupancy and revenue?
- ☐ Are learning, experimentation and policy feedback loops built in?
- ☐ Is there independent evaluation?
- ☐ Are regulatory sandboxes or pilots allowed?

 *No mechanism is set up to adapt if assumptions fail.*



Bibliography

- Interreg Europe (2020). *Smart Specialization Strategy (S3)*. Available at https://www.interregeurope.eu/sites/default/files/inline/Smart_Specialisation_Strategy_S3_-_Policy_Brief.pdf.
- Noronha M, da Silva RC and Celani G (2023). Placemaking in the design of knowledge-based urban developments: Extending CIM capabilities in the planning phase. *Joelho Revista de Cultura Arquitectonica*. July:91–112. Available at https://www.researchgate.net/publication/372383806_Placemaking_in_the_Design_of_Knowledge-Based_Urban_Developments_Extending_CIM_Capabilities_in_the_Planning_Phase.
- Stanford d.School (2021). *An Introduction to Design Thinking Process Guide*. Stanford University. Available at <https://web.stanford.edu/~mshanks/MichaelShanks/files/509554.pdf>.
- UNCTAD (2015). *Policies to promote collaboration in science, technology and innovation for development: The role of science, technology and innovation parks*. TD/B/C.II/30. Geneva. 9 February. Available at https://unctad.org/system/files/official-document/ciid30_en.pdf.
- UNCTAD (2024). *Science, Technology and Innovation Parks in Uzbekistan: Assessment and Policy Issues* (Geneva). Available at https://unctad.org/system/files/official-document/tcsdtlinf2024d7_en.pdf.
- UNCTAD (2024). *Science, Technology and Innovation Parks in Mozambique: Assessment and Policy Issues* (Geneva). Available at https://unctad.org/system/files/official-document/tcsdtlinf2024d3_en.pdf.
- UNCTAD (July 2024–August 2025). UNCTAD project on Science, Technology and Innovation Parks for Sustainable Development: Building expertise in policy and practice in selected Asian and African countries. Various presentations by experts. See <https://unctad.org/project/science-technology-and-innovation-parks-sustainable-development-building-expertise-policy>.
- UNCTAD (2025). *Science, Technology and Innovation Parks Development in Ghana: Assessment and Policy Issues* (Geneva). Available at https://unctad.org/system/files/official-document/tcsdtlinf2024d4_en.pdf.
- UNCTAD (2025). *Science, Technology and Innovation Parks Development in Mongolia: Assessment and Policy Issues* (Geneva). Available at https://unctad.org/system/files/official-document/tcsdtlinf2025d1_en.pdf.
- UNCTAD (2025). *Strengthening Science, Technology and Innovation Parks in National Innovation Systems of Developing Countries* (Geneva). Available at https://unctad.org/system/files/official-document/tcsdtlinf2025d3_en.pdf.
- UNCTAD (2025). *Strengthening Science, Technology and Innovation Parks for Industrial Development through Clustering* (Geneva). Available at https://unctad.org/system/files/official-document/tcsdtlinf2025d5_en.pdf.
- UNCTAD (2025). *Strengthening Science, Technology and Innovation Parks as Catalysts for Fostering Entrepreneurship in Developing Countries* (Geneva). Available at https://unctad.org/system/files/official-document/tcsdtlinf2025d7_en.pdf.
- UNCTAD (multiple years). *Technology and Innovation Reports* (United Nations publications. New York and Geneva). Available at <https://unctad.org/topic/science-technology-and-innovation/technology-innovation-report>.





unctad.org